146

THIS NUMBER COMPLETES VOLUME 64

VOLUME 64 [ANAT. REC.] NUMBER 4 AND SUPPLEMENT NO. 3

THE ANATOMICAL RECORD

CATALOGUED SEP 10 1936 M.D.F.

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PUBLISHED MONTHLY BY

THE WISTAR INSTITUTE OF ANATOMY AND BIOLOGY

WOODLAND AVENUE AND THIRTY-SIXTH STREET, PHILADELPHIA, PA.

Entered as second-class matter December 9, 1909, at the post office at Philadelphia, Pa., under Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on July 2, 1918

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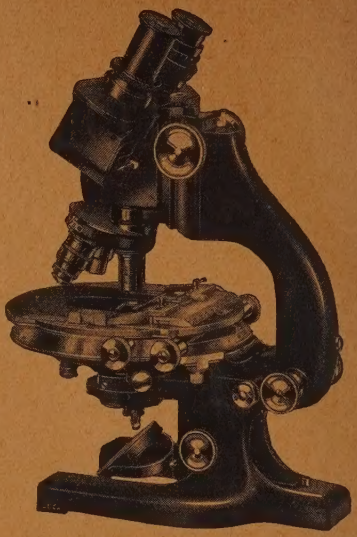

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FIFTY-SECOND ANNUAL SESSION

Duke University School of Medicine, Durham, North Carolina

April 9 to 11, 1936

ABSTRACTS

PAPERS TO BE PRESENTED

(The numbers in parentheses indicate the order in which the papers appear on the program of the meeting; the numbers in italics give the serial number of the abstract as printed herewith in alphabetical order of the authors' names.)

(125) *1. The relation of peritoneal mesothelium to lymphatic endothelium with reference to absorption of erythrocytes from the peritoneal cavity.* Lane Allen, Department of Anatomy, University of Georgia School of Medicine. (Introduced by Fred A. Mettler.)

Three opinions indicate routes for absorption of particulate matter from the peritoneal cavity: 1) absorption may be due to phagocytosis by peritoneal epithelium or particles may be forced mechanically, 2) through or, 3) between cells of the peritoneum.

Absorption occurs in the regions of the subdiaphragmatic lymphatic plexus. The lumina of these vessels are separated from the peritoneal cavity by a membrane consisting of lymphatic endothelium and peritoneal mesothelium. These layers are separated by a basement membrane in which perforations exist where the two layers are in contact.

Whole mounts of mouse diaphragm fixed shortly after intraperitoneal injection of frog blood show erythrocytes within the absorptive membrane. One end of each erythrocyte lies within the peritoneal cavity and the other end within a lymphatic vessel, the middle portion showing a constriction corresponding to a perforation of the basement membrane.

Impregnation with Ag NO_3, H and E shows erythrocytes situated between peritoneal cells and deep to these, between cells of the lymphatic endothelium.

It is concluded that absorption of erythrocytes (and other particulate matter) is an intercellular process; under proper mechanical conditions openings large enough to permit passage of frog erythrocytes exist between the peritoneal cavity and the lumina of subdiaphragmatic lymphatic vessels. These openings, however, are not 'stomata' in the sense of the term used by von Recklinghausen.

(19) *2. The effect of continued injections of progestin and combinations of oestrin and progestin on the endometrium of the castrated rabbit.* Willard M. Allen and George P. Heckel, Departments of Anatomy and of Obstetrics and Gynecology, The University of Rochester, School of Medicine and Dentistry.

Progestin produces in castrated rabbits the same histological changes in the endometrium as are found during the first week of pseudopregnancy. The minimum amount necessary to produce this change within 5 days is known as a rabbit unit. If the same minimal daily dose is continued for 10 days no proliferation is present on the eleventh day. The failure to maintain proliferation for 11 days has been found to be due to inadequate dosage; if larger doses are given (1.5 rb.u. per day) the uterus on the eleventh day looks exactly like that of a normal 11-day pseudopregnancy. Further, the same result is obtained if 1 mg. per day of either natural or synthetic β-progesterone is used, thereby establishing that this hormone by itself will produce in castrated rabbits all the histological changes which occur normally during the first 11 days of pseudopregnancy. If the same dose is continued for a total of 15 days the uterus shows in most cases little or no proliferation on the sixteenth day. However, if 100 r.u. of oestrin are given from the tenth to fifteenth days of the injections in addition to 1.5 rb.u. of progestin per day throughout, the uterus on the sixteenth day looks very much like that obtained from the sterile horn of a unilateral pregnancy of 18 or 19 days' duration.

(52) *3. The neuro-mechanism of the trunk limb component of the total behavior pattern.* A. W. Angulo y González, The Wistar Institute of Anatomy and Biology.

A study has been made of the histogenesis of the nervous system in a series of albino rat fetuses, ranging in size from 1.5 to 9 mm. C.R.L., and in age from 263 to 328 hours after insemination (premotile stage). A study was made of ninety-four of these fetuses impregnated by various silver nitrate methods (Cajal), and the fibrillation of the nervous system has been used as the index of histogenetic development.

This study shows that the motor system develops and is completely integrated by means of the descending ventral longitudinal path long before the development of the sensory system. The trigeminal is the first sensory nerve to develop in

the albino rat, followed closely by the vestibular nerve. When the spinal sensory system first develops, its fibers run cephalad to the nucleus gracilis and cuneatus without giving off collaterals in the spinal cord. At much later stages, collaterals develop from this tract which come into relationship with the local motor centers, but previous to the formation of these collaterals we find collaterals from the medial motor cell columns (which innervate the musculature of the trunk) that come in relationship with the motor cell columns of the lateral region (which innervate the musculature of the limbs), thus bringing about a direct integration between these two motor regions of the spinal cord. (See demonstration no. D3.)

(44) *4. Study of the lipoid in the cortex of the suprarenal glands of female dogs.* Dan D. Baker, Department of Anatomy, Louisiana State University Medical Center. (Introduced by B. I. Burns.)

The lipoid distribution in the cortex of the suprarenal glands of fifty female dogs has been studied. The left glands were embedded in 10 per cent gelatin and frozen sections were cut by mounting the chuck of the freezing microtome on the sliding microtome. With this arrangement thin sections of a fairly accurate thickness could be assured. Representative sections 10 μ in thickness were stained with Scharlach-R and counter stained with hemalum. These sections were projected and cut-outs were made from kodaloid which was used to obtain the percentages of the cortex most heavily laden with lipoid.

There was more lipoid in the cortex of the glands of immature and pregnant animals than in those in oestrus and dioestrus. The lipoid was slightly heavier in the outer portion of the cortex of pregnant than in immature animals. Large fat droplets were more numerous in the suprarenals of dogs in oestrus and pregnancy than in the others. The fat droplets in the cortex of immature animals were small and fairly evenly distributed. In oestrus the inner portion of the cortex contained less fat than in pregnancy but more than during dioestrus. The lipoid laden portion of the cortex represented the following percentages of the whole cortex: dioestrus, 60.2; oestrus, 67.1; lactation, 67.1; pregnancy, 72.1; and immatures, 77.4. The reticularis and the inner portion of the fasciculatis contained a small amount of lipoid.

(67) *5. Factors influencing the polarity of the lens in Amblystoma.* W. W. Ballard, Department of Anatomy, Dartmouth College. (Introduced by F. P. Lord.)

The nearly spherical lens of the larval Amblystoma eye has an inner and an outer pole, the lens fibers being arranged meridionally inside an epithelium. The epithelial cells form by mitosis, chiefly near the outer (corneal) pole of the lens, move medially over the surface of it, and are converted into lens fibers near the inner (retinal) pole by elongation and a sort of gastrulation process. The polarity of the lens is obvious in sections and is indicated in life by the 'lens-stars.' If the lens is taken out of the eye and replanted with its axis shifted, the old polarity is abandoned and a new one established with normal orientation to retina and cornea. Experimental evidence is submitted that this reorientation is due to a retinal influence on the growth of the lens epithelium.

1) Transitional stages of reorientation show cuboidal epithelium growing down over the former retinal pole, a region normally occupied by elongated fiber-forming cells. 2) New lens fibers are found which lie at a marked angle across the old ones. 3) Lenses abnormally placed in or near the eye orient themselves with reference to the greatest mass of retinal cells, and to satisfy this condition their axes may run dorsoventrally, anteroposteriorly or in other abnormal planes. 4) Lenses which develop in the absence of retinal relationship in Amblystoma either show arrested growth and no recognizable polarity, or are polarized with reference to some other part of the nervous system.

(33) *6. A phylogenetic study of changes in the secondary connections of the visceral afferent areas.* John W. Barnard, Department of Anatomy, University of Michigan. (Introduced by Elizabeth C. Crosby.)

A study of the secondary connections of the visceral areas associated with the facial, glossopharyngeal and vagus nerves reveals certain fundamental likenesses and differences.

In all vertebrates there are secondary connections to efferent nuclei of the same and lower levels. These connections increase greatly in birds and mammals because of the larger amount of viscera requiring innervation.

In fishes, amphibians and lizards there is a special uncrossed tract for forwarding gustatory impulses to higher centers. This tract ends in the secondary gustatory (or visceral) nucleus in the isthums region, from which impulses are relayed forward to the hypothalamus.

All forms up to and through reptiles show a crossed connection to the tectum. The bird shows but little of this and in mammals the tract passes through to the diencephalon without synapsing, this latter feature illustrating the principle of cephalization. As the thalamus becomes dominant in mammals the ascending systems pass directly to it without synapsing in the tectum, as in lower forms.

In birds and mammals there is a differentiation of the primary centers in that general visceral sensibility is restricted to the caudal portion of the visceral afferent area while special visceral sensibility, or taste (of which the bird has so little), is found only in the cephalic portion of the visceral afferent area.

(128) *7. Branchial glands in fishes.* Gerrit Bevelander, Department of Anatomy, College of Dentistry, New York University. (Introduced by Gustave J. Noback.)

Comparative study of the branchial epithelium of fishes reveals the occurrence of three types and seven subtypes of glands which are intimately associated with the branchial epithelium. These glands may be classified according to their morphological patterns, cytoplasmic contents, and other features relating to their structural complexity.

These glands may be arranged in a series which becomes increasingly more complex, but there appears to be little correlation between this complexity and the apparent evolutionary history of the fishes.

From the characteristic structure, arrangement, staining reactions and relationships which these cells exhibit, it is concluded that they are intra-epithelial mucous glands.

(13) *8. The effect of theelin injections on body growth and organ weights of the albino rat.* Oscar A. Billeter, Department of Anatomy, University of Minnesota. (Introduced by C. M. Jackson.)

Forty rats were spayed when 24 days of age, and subsequently injected with 0.01 cc. of theelin in oil per day (3 rat units) for 5 months, beginning the injections in 20 when 28 days old (short series), and in the other 20 when 6 months old (long series). Each series was controlled by 10 normal and 10 spayed controls. Effects of spaying: Marked increase in weights of body, head and integument, thymus, stomach (empty) in both series, and heart in short series. Decrease in weights of suprarenals, uterus, preputial glands, and probably hypophysis of both series. Effects of theelin injections: Complete recovery in weights of head, stomach, hypophysis of both series, and suprarenals of short series, with that of the body approaching normal in both series. Intermediate between spayed and controls are integument, thymus, uterus, preputial glands of both series, heart of short series, and suprarenals of long series. The spleen and the hypophysis of the spayed are heavier when compared with the injected, with normals intermediate excepting the hypophysis of the long series, in which the controls equalled the injected. No significant differences were found in lengths of body, tail, humerus, and femur; and weights of humerus, femur, thyroid, stomach with contents, intestines with or without contents, brain, lungs, liver, and kidney of both series, and heart of the long series.

(129) *9. The influence of the immature hypophysis and correlated glands in development.* Raymond F. Blount, Department of Anatomy, University of Minnesota.

The picture of immature hypophyseal function and alteration during development has been overshadowed by, and confused with, the pharmacological tests of adult gland substance upon the immature.

Evidence shows that the first hormones to appear are those of the pars intermedia regulating pigmentation and vasoconstriction. Embryonic implantation in the amphibian results in a darkening at a specific age. The vasoconstriction effects a reduction in integumentary parts and skeleton, particularly of tail and limbs. General growth is slowed by a diminution in alimentary canal size and probably by the kidney disfunction. There is no good evidence of a growth stimulating hormone in the young individual. Reduced growth following hypophysectomy may be as well explained by the altered gut of these individuals. The growth stimulating factor appears late in larval life as judged by the disproportionate overgrowth of skeleton with acromegalic tendencies.

The thyrotropic hormone of the immature produces the secretory and storage phase of thyroid function but not the discharge phase. It is suggested that there are two pituitary hormones, one for secretion and storage and another for release. The former makes its appearance the earlier.

There is some indication that there is an adrenotropic hormone in the immature, but the gonotropic hormone appears late.

Many phases of the interaction of hypophysis and other endocrines during development remain but partially explained.

(51) *10. An experimental study of the optic tracts and retinal projection of the Virginia opossum.* D. Bodian, Department of Anatomy, The University of Chicago. (Introduced by C. Judson Herrick.)

The optic tracts and centers of thirty opossums were studied by the Marchi and reduced silver methods after lesions of the optic nerves or of retinal quadrants. The following conclusions were reached: 1) Fibers from each retina end in the dorsal nuclei of both lateral geniculate bodies, in both superior colliculi, and in the contralateral nucleus of the posterior accessory optic tract. No retinal fibers could be traced to any other brain centers. 2) Fibers from localized retinal segments pass to definitely localized regions of the lateral geniculate body and superior colliculus. The pattern of these projections has been mapped in detail and agrees in the main with that described for the rabbit by Brouwer. 3) The projection of the retinal quadrants on the striate area has also been mapped, and reveals a striking correspondence of homologous retinal projection areas in the opossum, rabbit, dog, and monkey. 4) The optic tract as it passes over the lateral surface of the thalamus contains, in addition to retinal fibers, fibers of Gudden's commissure, and also cortico-geniculate and cortico-tectal fibers, which leave the dorsolateral part of the cerebral peduncle and pass into the optic tract as it rounds the peduncle. 5) No normal fibers were found in reduced silver preparations of optic nerves 10 weeks after removal of one or both eyes.

(25) *11. A preliminary study on the size of nerve cells in the cerebral cortex.* Gerhardt von Bonin, Department of Anatomy, College of Medicine, University of Illinois.

The size of nuclei of cortical cells situated in different areas of the cerebrum was measured, and the resultant distribution curves were statistically analyzed.

The shape of the distribution curve can be ascertained from about 250 observations. It is skew with the mean and the mode nearer to the smaller size of the cells in all areas measured: in the somato-sensory and the somato-motor area (postcentral and precentral gyre) and in various areas of the frontal lobe. The distribution comes nearest to the 'normal' curve at the frontal pole, in Economo's 'type 3.'

It is possible to compare a distribution curve as a whole with another one by means of the 'chi-square' test. This leads to a classification of the frontal lobe areas into broader groups, the significance of which will have to be ascertained by further studies.

(42) *12. The distribution of the pepsin-forming cells in the stomachs of various animals as revealed by new methods of staining.* D. J. Bowie, Department of Histology and Embryology, McGill University, Montreal. (Introduced by H. E. Rawlinson.)

In the stomach of the animals studied there is a region on the greater curvature toward the cardiac end in which the body of the gland is composed mainly of pepsin-forming cells. Proceeding toward the pylorus, the peptic cells decrease in number and occupy only the deeper portions of the body of the glands. They

disappear in the so-called intermediate zone. With the decrease in the number of peptic cells there is a corresponding increase in the number of mucous cells in the body of the gland. This establishes a gradient for the distribution of peptic cells, a fact of great importance in histological investigations on the gastric mucosa, and the new methods of staining developed here permit of a very accurate analysis of this gradient. (See demonstration no. D7.)

(1) *13. The phylogeny of the sphincter choledochus.* Edward A. Boyden, Institute of Anatomy, University of Minnesota.

The sphincter of the common bile duct in higher mammals represents a vestige of the intrinsic musculature of the extra-hepatic biliary tract.

In bony fishes (Higgins, '28), evacuation of bile is accomplished by peristaltic waves that extend from gall bladder to duodenal orifice. In the opossum (DuBois and Hunt, '32) the waves begin in the lower two-thirds of the common bile duct; outside the duodenum, bile and pancreatic ducts form a dilated chamber, the function of which is to ejaculate bile through an intramural duct into the intestine. This ampulla and duct have outer circular and inner longitudinal muscular coats entirely independent of the tunica muscularis duodeni. In the somewhat comparable apparatus of the guinea pig the principal sphincter encircles the bile duct proximal to the ampulla. In the human embryo the homologous sphincter is drawn into the wall during fetal stages (see demonstration) and is the principal mechanism by which bile is retained. Both ampulla and duct seem to have undergone partial involution; indeed, in 76 per cent of adult individuals the common outlet is either absent or is not more than 2 mm. in length (Mann and Giordano, '23). Similarly its weak musculature and the apparent suppression of its inner longitudinal coat suggest that it has lost the power of ejaculation—a function no longer needed in view of the lessened interference offered by the duodenal wall.

(14) *14. Effect of theelin and of corpus luteum extract upon skin proliferation.* William Brown, John C. Wright, Harlow Ades and Fred A. Mettler, Departments of Biochemistry, of Gynecology and of Anatomy, University of Georgia Medical College, and Department of Zoölogy, University of Illinois.

The number of mitotic figures in the skin of the mouse is raised by the administration of theelin and lowered by the administration of corpus luteum extract indicating an increase and a decrease, respectively, in the rate of dermal proliferation.

The animals chosen were all young males, mature, and of the same body weight and nearly the same age. Hourly variations in dermal proliferative activity can be eliminated as a factor in the production of the above results.

(22) *15. Electro-dynamic studies of mice with developing cancer of the mammary gland.* H. S. Burr, G. M. Smith and L. C. Strong, Yale University School of Medicine.

Using the Burr-Lane microvoltmeter (see demonstration no. D10) studies have been carried on for the past year in a genetically controlled strain of albino mice, reared by L.C.S., in order to determine what changes, if any, occur in the

mouse in association with developing cancer in the mammary gland. The animals have been studied biweekly, beginning with the 135th day of age. The determinations are made on the animal before the advent of cancer, during its development, until death. Six of the forty mice under observation have developed cancer. One of these died too early for a complete history. Five have shown a marked rise in the voltage differences measured through the chest a week to 10 days before the cancer was recognized by palpation. Axial readings from xyphoid to symphysis, and groin readings fail to show this rise. The findings suggest that the electrodes reflect not only the local activity of their immediate environment, but also changes in the total electrical activities of the whole organism. In other words, we are dealing with a field phenomenon which is radically disturbed by the cancerous process at sometime previous to its recognition by direct observation. (See demonstration no. D10.)

(48) *16. Studies in the dynamics of histogenesis. XVI. The pressure wave-mechanics of the transitional type of musculature in the gizzard of the wild mallard (Anasplatyrhynchos boschas).* Eben J. Carey, Department of Anatomy, Marquette University.

The gizzard musculature of the wild mallard has long, wide intercommunicating fibers with many central nuclei. Different places of the same fiber have the microscopic characteristics of either smooth or cross-striated muscle. Each striation averages 50 μ in length and consists of two equal or unequal parts: 1, narrow, clear transverse, regular or irregular band, 10 to 20 μ in length, measured in the long axis of muscle fiber, relatively free of nuclei; 2, broad, dark band 20 to 40 μ in length with many elongated or diploid nuclei. The clear and dark parts of each pressure contraction wave are, respectively, zones of condensation and rarefaction. These striations, longer than those in heart muscle, have zig-zag irregularities near fiber branchings. The variable patterns and lengths of these regular and irregular pressure waves in muscle are analogous to those of sound pressure waves in unbranched and branched glass rods. Rectangular plate-glass rods with fusiform openings explode by lateral expansion when there is localized amplification by multiple irregular reflections of pressure waves of sound. These waves are produced within the glass rod by hand-friction-rub with paper towel moistened with xylol. Regular fronts composed of multiple pressure waves are produced in elongated capillary glass tubes, 90 μ lumen diameter, by directed Brownian motion of gamboge particles bombarded by enclosed, aligned water molecules. (See demonstrations nos. D11 and D12.)

(121) *17. Observations on polymorphonuclear leukocytes in the living animal.* E. R. Clark, E. L. Clark and R. O. Rex, Department of Anatomy, University of Pennsylvania.

Polymorphonuclear leukocytes were studied microscopically in the living animal in transparent tails of Amphibia and in chambers installed in rabbits' ears. They were observed in the circulation, in the act of migrating through vessel walls and in the outside tissue.

Adhesion of leukocytes to and their migration through the endothelial wall apparently depend upon progressive changes in endothelial consistency.

Migration of polymorphs outside vessels and chemotactic and phagocytic reaction toward various injected foreign substances were observed and their behavior distinguished from that of macrophages and lymphocytes.

In micro-inflammations produced by injecting dilute croton oil into tadpoles' tails, individual polymorphs were observed continuously with the oil immersion lens. They underwent changes in form, lost their cytoplasmic granules, and, after 24 to 30 hours, rounded up, their poly-lobed nuclei coalescing to form single round or oval nuclei.

In rabbit's ear chambers emigrated polymorphs moved actively for 24 hours, then became more and more sluggish, gradually lost their granules, dwindled in size, and their nuclei became spherical. These changes were best seen in polymorphs which migrated into blocked lymphatics where the same group could be followed for many days. After the first 40 hours they were susceptible to phagocytosis by macrophages, but many escaped this fate for weeks, remaining as small, round-nucleated, practically stationary cells which simulated lymphocytes in shape and size but differed radically in activity.

(107) *18. The effect of mare gonadotropic hormone on the mature non-pregnant female rat.* H. H. Cole, College of Agriculture, University of California, Davis.

Single injections of 6 to 24 R.U. of mare gonadotropic hormone were given to nine rats in dioestrum, eleven in oestrus and sixty-one in metoestrum. Approximately 75 per cent of the matings were fertile in rats injected in oestrus and metoestrum with 6 to 12 R.U. and bred in the succeeding oestrus while but four of nine injected during dioestrum became pregnant. As in the infantile rat ovulation is inhibited by larger doses. Only four fertile matings resulted in a group of eighteen rats injected with 18 to 24 R.U. in early metoestrum.

Although none of the litters exceeded the maximum size for our strain, six of twelve rats receiving 12 R.U. in early metoestrum had sixteen to nineteen foetuses—a higher frequency of large litters than is normally found in our colony. If very large numbers of ova are liberated following treatment with mare gonadotropic hormone, as in the infantile rat, most of the excess number undergo dissolution.

(29) *19. Effects of cortical removal upon hematopoesis and gastric activity.* J. D. Combs, Cecilia C. Mettler, Joseph Krafka, Jr., and Fred A. Mettler, Department of Histology and Embryology and Anatomy, University of Georgia Medical College.

Ablation of cortex of the anterior portion of the brain in the dog produces a marked drop in the erythrocyte count made on peripheral blood. This is followed by an increase in the total hydrochloric acid of gastric juice and by a reticulocytosis which later disappears when the erythrocyte count is restored to nearly normal levels. The erythrocyte response to adrenalin of such animals is from two to five times greater than that of normal animals indicating a visceral vasotasis particularly in the spleen. This is supported by ventriculoscopic examination which reveals hyperemia of the gastric mucosa. Although the initial reticulocytosis disappears the bone marrow manifests an essential

instability by periodic reticulocyte storms for a long period afterward. The blood pressure of operated animals is within normal ranges. Leucocyte and differential counts show no marked changes. Occipital ablation does not produce these effects.

(23) *20. Postnatal development of cerebral cortex: Parietal and occipital lobes at birth.* J. LeRoy Conel, Department of Anatomy, Boston University School of Medicine and Massachusetts Memorial Hospitals.

The distribution of cell bodies closely resembles that in the adult cortex. In the parietal lobe cell processes are more advanced in development in the posterior central gyrus than elsewhere. The outer layer of Baillarger is more prominent in PB than in FA; the inner layer shows the reverse condition. Association fibers are more numerous and contain more myelin in PB than in FA. Projection fibers are less in size, number and myelin in the posterior than in the anterior central gyrus. Myelin is present in the posterior central gyrus only.

Cell processes in the occipital lobe are slightly more advanced in development than those in PB; projection fibers are smaller and less numerous than in PB. Myelin is present only in area striata and is much less in quantity than in PB. Myelin is present in the optic radiation in less quantity than in the corona radiata.

(79) *21. The classification and terminology of extra-organic gross connective tissue structures.* E. D. Congdon, Brooklyn.

Apparently the medical student can nowhere find a general discussion and a complete terminology of the major groups of extra-organic gross connective tissue structures. The conflicts and inconsistencies of terminology in this field are probably the greatest to be encountered by him in the entire study of anatomy.

Eight types of extra-organic gross connective tissue structures seem to merit recognition, namely, panniculi adiposi, fasciae, sheaths, shearing layers of very loose connective tissue, mooring tracts of intermediate or dense connective tissue holding organs to the musculo-skeletal layer of the body, ligaments connecting skeletal elements, retinacula, and finally blends of two or more of the preceding groups with one another or of certain of these groups with some intro-organic gross connective tissue structure such as periosteum.

Concentric and linear bodily divisions are also considered as a basis for a sub-division of the above groups on topographic grounds. Here, too, we meet with conflicting usages of fundamental terms.

(24) *22. Notes on the cerebral cortex of the ostrich.* E. Horne Craigie, Department of Biology, University of Toronto.

The cerebral cortex of the ostrich shows the same subdivisions which have previously been described in the emu and in the cassowary, but they are in general less sharply differentiated. The dorsal division of the parahippocampal cortex, which is distinctly multilaminar in the emu, is in the ostrich only faintly laminated ventrally and not at all so dorsally, where it expands into the accessory hyperstriatum without noticeable change in structure. This area is broader in the ostrich, however. These features of the ostrich brain might be interpreted either as more primitive or as more degenerate than those in the emu, the probabilities on the whole seem to favor the former view.

(27) *23. Autonomic responses elicited by stimulating the frontal region of the cerebral cortex of the cat.* Richard L. Crouch and Kenneth Thompson, Department of Anatomy, University of Missouri.

The frontal region of the cortex of cats was stimulated by a tetanizing current from a 3-volt dry cell. Changes in blood pressure, heart rate and pupillary dilatation were studied. The animals were given just sufficient curare to paralyze all somatic movements including respiration and the animals were kept alive with a pulmotor. All operative work was done under local anesthesia so that the possibilities of general anesthesia affecting the results might be eliminated.

When the frontal or sigmoid gyri were stimulated an increase in blood pressure, increase in heart rate and dilation of the pupils were produced. The cortical area immediately surrounding the sigmoid gyrus gave no response when minimal strengths currents were used for stimulations.

(71) *24. Dermatoglyphic stigmata in mongolian idiocy.* Harold Cummins, Department of Anatomy, Tulane University.

Dermatoglyphics of palms and finger tips in mongolian idiots show peculiarities which may be regarded as constitutional stigmata. As in other constitutional and racial expressions of dermatoglyphic variation, the distinctions appear here as trends characterizing the group, rather than in the occurrence of traits which are diagnostic in the individual case. The importance of dermatoglyphics as constitutional signs lies in their early definitive formation; since they display unusual characteristics in the present series it follows that physical distinctions of mongolian idiocy exist at least as early as the third and fourth fetal months, when the configurations are differentiated.

In the finger tips and palms of some sixty mongolian idiots the following peculiarities are observed, in contrast to a racially comparable control. Among finger tips there is a noteworthy reduction of the whorl type (frequency 19.8 per cent). There is a heightened tendency toward transverse alignment of ridges over the distal palmar region. Hypothenar, second and third interdigital patterns are more frequent, while the thenar/first interdigital and fourth interdigital are reduced. The prevailing hypothenar configurations are of the single expansive types (Lu, for example, occurs in over 1/3 the palms, as against about 1/50 in the normal; A^c in about 1/5 the palms, as against 1/100 in the normal). Axial triradii t″ are about eight times as frequent as in the control.

(37) *25. Photodynamic effects of fluorescent substances and the vital staining of organs.* Elizabeth B. Cuzzort, Research Department, St. Clare's Hospital and Tumor Institute, New York. (Introduced by Edward Singer.)

Changes accompanying photodynamic effect of some dyes were observed within the living cells, that were examined with Singer's fluorescence microscope using a total magnification of × 600. The sudden and striking action of thioflavine S and berberine sulphate were most definite among them.

Thioflavine S shows a variety of colors in different media. In nuclei of living cells thioflavine S is blue, in the circulating blood serum it is yellow, after ultraviolet irradiation lasting 3 to 5 minutes, the endothelial cells of the capillaries become orange-yellow and accompanying this color change a spasm occurs

constantly in definite blood vessels. This spasm is best demonstrable in the efferent vessel of the glomerulus.

Berberine sulphate stains first the cystoplasm leaving nuclei dark. After ultraviolet irradiation the staining reverses.

(89) *26. The relation of the lymphocyte to blood formation in urodeles. Observations on Necturus maculosus under normal and experimental conditions.* Alden B. Dawson, Biological Laboratories, Harvard University.

In normal Necturus, typical lymphocytes are practically absent from the blood stream and the hemocytoblasts present are regarded as potential erythroblasts since all other blood-cell elements differentiate at least partially in the blood-forming tissues.

In lead poisoning, following splenectomy, small lymphocytes become numerous in the circulation and form the chief source of new thrombocytes and erythrocytes. There is no compensatory erythropoiesis in any of the remaining hemopoietic loci. The circulation becomes the sole locus of erythrocyte differentiation and multiplication.

In animals, splenectomized 6 months previously, the thrombocytes were marked with a single, intravascular injection of India ink and the history of carbon-bearing thrombocytes was followed for long periods. During the first 139 days the percentage of thrombocytes with carbon was steadily reduced. From 139 to 259 days the number of cells fluctuated slightly; then rose significantly for the next 100 days. The new thrombocytes with carbon appear to come from fixed cells which had stored carbon after the injection. Eleven months after injection a few carbon-bearing erythrocytes appeared in the circulation. These were probably derived from fixed cells containing carbon. The small numbers of such erythrocytes and their late appearance, in contrast to the thrombocytes, is related to the capacity of the immature erythrocytes to multiply rapidly by mitosis in the circulation, whereas the thrombocytic series rarely divide in this location.

(65) *27. Effects of formalin on afterbirth weights.* Marie Dees-Mattingly, Department of Anatomy, Tulane University.

The weight fluctuations of twenty-four afterbirths in formalin over a period of 21 months are analyzed. Prior to weighing in the fresh state, the afterbirths were lightly sponged and allowed to drip for 30 minutes. The cord and membranes were then cut close to the placenta and each separately weighed. Each afterbirth was placed in 1500 cc. of 10 per cent formalin. Weights were made daily for 9 days following, then weekly for 5 weeks, once after a 2-week interval, monthly for 2 months and thereafter at intervals of 2 or 3 months. Weight changes for the total afterbirth and for each component, placenta, cord and membranes, are separately recorded. Individual graphs of weight fluctuations for each of the above are shown. A sharp initial rise in weight is evident after the first day in formalin, a further increment occurs during the next day or so and is maintained for several days, after which there is a long-continued drop. The weight at the close of the 21-month interval is still above the original fresh weight. Low and high weight afterbirths yield curves essentially the same in contour but differing in degree of elevation, heavy afterbirths showing a smaller relative gain, and eventually a closer approximation to the original fresh weight.

(4) *28. The hormonal production of sexual receptivity in the female guinea pig.* Edward W. Dempsey, Roy Hertz and William C. Young, Department of Biology, Brown University.

The following data are believed to confirm the hypothesis (Proc. Am. Assoc. Anat., 1935) that the action of oestrin alone does not produce sexual receptivity. 1) Only 14 per cent of injections of 1000 I.U. oestrin in twenty-one normal animals and 31 per cent of fifty-four injections in thirty spayed animals were followed by sexual receptivity. The latent period averaged 35.3 hours. 2) Intravenous injections of 0.2 gm. equivalent sheep luteinizer produced heat and ovulation in nineteen of twenty-four cases injected on the twelfth to fifteenth days of the dioestrum, but were ineffective earlier in the cycle in fifteen cases. The latent period averaged 5.8 hours. Similar injections into four spayed animals were ineffective and the combination of oestrin and luteinizer did not enhance the efficiency of oestrin in fifteen cases. 3) Injections of 40 I.U. or more of oestrin followed 36 or 48 hours later by 0.2 I.U. progesterone invariably produced heat in twenty-four spayed animals. The latent period after progesterone administration averaged 4.8 hours. Seven of nine normal animals injected with 0.2 I.U. progesterone alone on the fourteenth or fifteenth day of the dioestrum came into heat 5 to 10 hours later, but did not ovulate.

It is postulated for this species that after conditioning with oestrin, heat is caused by progesterone produced under the influence of the luteinizing hormone during the preovulatory enlargement of the follicle.

(45) *29. Gross distortion of histological material in the fixation process.* Wilfrid T. Dempster, Department of Anatomy, University of Michigan.

One cubic centimeter pieces of vertebrate liver, muscle, etc. immersed in fixing fluids show changes in bulk which exceed normal physiological fluctuations. Fixatives that contain agents other than strong alcohol induce tissue swelling during the first few hours of penetration. The volume of tissue often increases by a quarter or more, and the standard fixing mixtures are, in most cases, no better than simple agents alone. A similar swelling occurs when tissues are immersed in such isotonic fluids as Ringer's solution or blood serum, while more extensive and rapid swelling occurs with water. The effect is likewise apparent to a varying degree in hypertonic fluids.

In fluids containing sublimate, picric or trichloracetic, the initial swelling is followed by shrinkage which varies in rate and degree with each agent. With other fixatives, the swelling action may continue for some time before shrinkage, or the shrinkage may be slight during ordinary periods of fixation.

Data suggest that water is extracted from the killing agent and absorbed into the unpreserved part of the tissue with a ballooning of the whole piece. With further penetration of fixatives comes shrinkage. The extent of swelling, with a specific fixative, and the onset of shrinkage vary with each type of tissue. The swelling-shrinkage action produces visible gross distortion, influences volume in dehydration and embedding stages and increases volume variability in otherwise similar tissues.

(110) *30. The effect of pituitary hebin upon the reproductive system of the chick embryo.* L. V. Domm and E. A. Dennis, Department of Zoölogy, The University of Chicago. (Introduced by F. R. Lillie.)

Pituitary hebin was injected into albumen and allantoic cavity of incubating eggs. Single and repeated injections were made daily and alternate days beginning at 48 hours and majority terminating on ninth day. Number of injections varied from one to six, volume from 0.05 to 0.3 cc. and dosage from 5 to 30 R.U. Development continued to eighteenth day. A hybrid variety with sex linked plumage and brown Leghorns were used.

Macroscopic examination revealed hypertrophy of gonads which was particularly pronounced in cases receiving higher concentrations. The degree of hypertrophy varied being more general and pronounced in females than males. While hypertrophy of ovaries was striking that of rudimentary right gonad was particularly so. This gonad, normally small and difficult to find, was frequently larger than the normal left rather significant considering its behavior in our post-embryonic experiments. The surface of both gonads was usually smooth though the right in some of larger ones revealed small projecting vesicles and sometimes had a honey-comb appearance.

Histologically, experimental ovaries reveal a narrow, irregular, discontinuous, layer of cortex clearly distinguishable from underlying medulla. The medulla comes to the surface wherever cortical layer is broken. Medullary hypertrophy is conspicuous and evidently greater size of experimental ovaries is primarily due to its growth. The right gonad is predominately medullary and varies from a rather loose arrangement with many large irregular spaces to a firm condition with few small spaces. (See demonstration no. D17.)

(58) *31. The motor and sensory fibers in the vagus nerve of the cat.* Franklin S. DuBois and James O. Foley, Department of Anatomy, University of Alabama.

The right vago-accessory roots were sectioned intra-cranially in two cats and, after allowing 21 days for degeneration of motor fibers, counts of the fibers in silvered preparations of the right vagus proximal to the nodose ganglion were made and compared with similar analyses of the left vagus of the same animal. The results indicate that the vagus is predominantly a sensory nerve (at least 70 per cent).

In view of this fact it becomes important to know approximately how many of the sensory fibers originate in the jugular ganglion. This phase of the problem was attacked by sectioning the auricular nerve (seven cats) and by sectioning the trunk of the vagus just distal to the jugular ganglion (five cats). After allowing 10 to 18 days for retrograde changes, estimates of the total number of cells and the number of chromatolytic cells in each jugular ganglion were made. The data thus obtained demonstrate that there are from 7000 to 10,000 cells in the ganglion, that more than two-thirds of the cells undergo frank chromatolysis after section of the auricular nerve and that less than one-fifth show similar changes following section of the vagus. These facts suggest that the majority of the jugular fibers are distributed peripherally via the auricular nerve and that relatively few descend in the trunk of the vagus. (See demonstrations no. D18, D24.)

(57) *32. Some determinations of the ratio of fibers to cells in the thoracic dorsal roots and ganglia of the cat.* Donald Duncan and Lester L. Keyser, Department of Anatomy, University of Texas.

All axones made visible by the pyridine silver method in cross sections of twenty-two thoracic dorsal roots were counted. The material was obtained from five healthy cats, and included one or more of the fourth to the ninth thoracic dorsal roots. The number of nerve fibers in any root varied from 5012 to 8331. The number of ganglion cells was determined by counting the nucleoli stained with toluidin blue, eighteen determinations gave a range for cells of 4794 to 8561. The number of fibers per cell from the root and ganglion of the same nerve varied from 0.91 to 1.08. Eight determinations were above one fiber per cell, five were less than one fiber per cell, and two were practically one to one. It is concluded that the number of fibers in any thoracic dorsal root is slightly greater than the number of cells in the ganglion, and that counts indicating fewer fibers than cells are due to failure of the staining method.

(68) *33. An attempt to castrate the chick embryo with x-rays.* J. M. Essenberg, Department of Anatomy, Loyola University School of Medicine, Chicago. (Introduced by R. M. Strong.)

In order to destroy or inhibit the formation of the primordial germ cells, chick embryos were exposed to x-rays at 16, 18, 20, 22 and 24 hours of incubation. Each age group was treated to 400, 550 and 600 units of x-rays. From former work it is known that with the present set-up of the machine and age of the material 600 r is lethal to 96.5 per cent of all embryos irradiated. After radiation chick embryos were allowed to incubate to ages 2, 3 and 6 days. In 24 hours after radiation with non-lethal dose, recovery is well under the way although pienotic and degenerating cells are abundant. In 3-day embryos the germinal epithelium is in formation; differentiation of germ cells takes place; all intermediate stages are present but fully formed or precocious germ cells are seldom found. Chick embryos of 6 days radiated with non-lethal doses, show apparently normal gonads with germ cells in all stages of differentiation. Embryos irradiated with lethal doses may show malformation and rarifaction of tissues but unmistakable germ cells are present.

(130) *34. The hormonal control of anuran metamorphosis.* William Etkin, College of the City of New York and the American Museum of Natural History. (Introduced by B. H. Willier.)

An attempt will be made to evaluate the available evidence upon the following problems: 1) the mechanisms that control the sequence and spacing of the complex of events that constitute anuran metamorphosis and 2) the factors determining the time at which the pituitary activates the thyroid and the degree of such activation.

With regard to the first it will be shown that the sequence of events is inherent in the nature of the responding tissues and is independent of the concentration of thyroxine. The relative spacing of events in time is, however, dependent upon a definite pattern of increase in the concentration of the hormone. That the normal development of the gland is harmonious with this concept is shown by growth and histological studies.

With regard to the second, evidence will be presented indicating that the development of thyrotropic activity in a grafted pituitary is independent of the maturity of the host and is not subject to activation at the time normal for metamorphosis in the host. Further the pattern of increasing activity in the thyroid appears dependent upon a like pattern of increase in the production of thyrotropic hormone. The interpretation is suggested that the time and the pattern of metamorphosis is dependent fundamentally upon the rate of functional 'self-differentiation' in the pituitary characteristic for each species.

(104) *35. Differential relations of basal elements of human cranium; some correlations of foot and hand bones.* Thomas Horace Evans, Department of Anatomy, Long Island College of Medicine, New York Homoepathic Medical College and Flower-Fifth Avenue Hospital.

In type A, Cope (two molars) and amphi-Cope (three molars), the horizontal plates of maxilla and of palatinum adjoin the level of first upper molars; sagittal midline measurement is short; base of ectopterygoid is rostrolaterad to foramen ovale; occipital condyles are rostrad to rim of foramen magnum; carotid canals are transverse. In type B, Keith (three molars), the maxillopalatine juncture is at level of third molars; sagittal midline measurement usually short. In type B, neomorph Gregory, there is room for fourth molar or it is produced; base of ectopterygoid mesad to foramen ovale; occipital condyles at rim of foramen magnum; carotid canals rostrad; posterior palatine canals at or behind third molars; entopterygoids diminishing; sphenoid invading mandibular fossa; mandibular foramen is higher than level of molar crowns; metopism or interfrontal ridge appears; paroccipital processus indicated. In intermediate type C, Wissler, the sagittal midline palatine measurement is long; three or four molars appear; ectopterygoid is laterad to foramen ovale. With additional cranial evidences, and using the index of metapodials, the lengthening of second in foot is shown favoring cuboidonavicular facet as intermediate to late stage (95 per cent in Pueblo with navicular square cup form).

(109) *36. Effect of pregnancy urine extract (Follutein) upon normal and transplanted gonads and upon the external genitalia in guinea pigs.* Emil A. Falk and George N. Papanicolaou, Departments of Anatomy and Medicine, Cornell University Medical College, New York City.

We reported previously that administration of pregnancy urine extract (Follutein) in female guinea pigs produces enlargement of the clitoris to the size of a small penis. In young males the penis is stimulated to premature growth. The removal of the ovaries or testicles before treatment suppresses the stimulating effect upon the external genitalia.

Testicles and ovaries of treated animals show extensive hypertrophy of the interstitial tissue. It is, therefore, reasonable to attribute the above effect to the increased activity of the interstitial cells.

Treatment of animals with autotransplantation of ovaries or testicles showed very slight or no effect upon the secondary sexual organs. The sex glands of such animals showed very slight or no stimulation of the interstitial cells. In the ovaries large follicles and corpora lutea were occasionally present. These findings prove further that the stimulated interstitial tissue is responsible for the effect upon the external genitalia.

The inability of the pregnancy urine hormone to stimulate adequately the interstitial cells in transplanted gonads does not support the view that these cells are primarily affected. The pronounced general circulatory stimulation in treated animals suggests the primary effect as being upon the vascular system, either directly or through the nervous system. The cutting out of the normal blood and nerve supply during transplantation abolishes or greatly diminishes the reaction.

(116) *37. Effect of phenol indophenol dyes on the pigmentation of normal and hypophysectomized amphibians.* Frank H. J. Figge, Department of Anatomy, University of Maryland.

In 1902, Mrs. Margaret R. Lewis reported that "frog eggs grown in tap water containing the dye phenol indophenol exhibited a complete lack of the pigmented layer of the optic cup and a marked pallor of the skin." This work was repeated and confirmed in 1933, using frog and Amblystoma punctatum eggs. Because of the striking resemblance between the dye pallor and the hypophysectomy pallor, the effect of the dye was tested, in 1935, on normal and hypophysectomized Amblystoma punctatum, as well as on black and white Mexican axolotls and Necturi. The post-hatching stages of these were kept continuously in solutions of phenol indophenol or O-cresol phenol indophenol for a period of 3 months. The dyes do not exert their influence on pigmentation via the hypophysis, because they reduced the pigment which is normally present in the margin of the tail of the hypophysectomized Amblystoma punctatum larvae.

From a comparative study of the pigmentary reactions in the various forms used, it appears that the effectiveness of the dye parallels the metabolic rate of the animal. The dyes are most effective in producing a lack of pigment in Necturi, less effective in Amblystoma tigrinum, and least effective in Amblystoma punctatum. The phenol indophenol dye causes a lack of both black and yellow pigments, while the O-cresol phenol indophenol dye reduces only black pigment. (See demonstration no. D23.)

(18) *38. Atypical uterine and vaginal changes in mice receiving large amounts of estrogenic hormone.* W. U. Gardner, E. Allen and L. C. Strong, Department of Anatomy, Yale University School of Medicine.

In recent experiments a large number of normal female mice from several inbred strains were given large amounts of benzoate of ketohydroxy estrin. It was administered subcutaneously in oil solution, usually at the rate of 500 i.u. per week. Reactions of animals started at different ages were strikingly different.

When injections were started following weaning age many mice died after a few weeks treatment. The uteri were usually greatly enlarged and adherent to the surrounding viscera. Pronounced pyometra had developed. Most of the uterine epithelium was destroyed and the canals were distended with debris. The vaginas were distended with cornified cells.

When the injections were started shortly after birth, decidedly different results were observed. The uteri remained small. The uterine muscles and connective tissue were poorly developed and glands were rare or absent. The entire epithelial lining was stratified but not cornified; this metaplasia frequently extended into

the uterine ends of the fallopian tubes. The vaginas were greatly enlarged by an increase in thickness of the connective tissue of the walls. This involved a mucoid or gelatinous transformation of the stroma comparable to the connective tissue changes involved in the 'sexual skin' of monkeys and the cock's comb, and suggestive of a myxomatous transformation. Though the vaginal epithelium was thickened, a marked cornification was not observed. These atypical uterine and vaginal changes have not been described previously as systemic reactions.

(112) *39. Lactation in adrenalectomized rats.* Robert Gaunt and C. E. Tobin, Departments of Biology, Washington Square College, New York University, and College of Charleston, S. C. (Introduced by Harry A. Charipper.)

The factors involved in the reported lactation deficiencies in adrenalectomized animals were studied. Rats adrenalectomized just before delivery and treated with adequate live-maintaining doses (1 cc. per day) of Swingle-Pfiffner cortical extracts raised their litters in only four of ten cases. Growth of the surviving young was sub-normal. Similar results were obtained with salt-treated adrenalectomized rats. A combination treatment of cortical extract plus salt prdouced lactation that approached but did not quite reach normal. All litters lived and lactation was normal, however, when doses of cortical extract were increased to 2 cc. per day (an amount more than twice that necessary to keep the adrenalectomized mothers alive).

When later cortical extracts of greater life-maintaining potency were used, their effectiveness in supporting lactation in adrenalectomized rats was proportionately increased. The addition of Prolactin (Squibb) to life-maintaining doses of cortical extracts did not remedy the lactation deficiencies. The similar addition of anterior pituitary extract (Squibb) inhibited lactation. Removal of ovaries luteinized by Follutein (Squibb) resulted in lactation in half of the cases in adrenalectomized rats.

It is suggested that the adrenal cortex is involved in lactation only in that it is necessary to have an increased amount of cortical hormone to compensate for the fluid and electrolyte drains resulting from milk secretion. No evidence was found verifying reports that there is a lactogenic hormone in the adrenal cortex, distinct from the life-maintaining hormone.

(81) *40. Does bone-conducted sound reach the inner ear by way of the air-conduction mechanism?* Stacy R. Guild, Otological Research Laboratory, Johns Hopkins University.

Sound waves were transmitted to the heads of anesthetized cats through a piece of hard wood 12 inches long, held against the skin over the lateral end of the occipital ridge. Sources of sound waves were stems of magnesium tuning-forks and a hearing-aid type of bone-conduction receiver attached to an audiometer. The changes in electrical potential produced in the inner ear, as picked up by an electrode in the region of the round window niche, were passed through a six-tube amplifier and converted into sound waves by a telephone receiver. Sounds thus transmitted through the normal ear of a cat can be heard when the source is vibrating at an intensity no greater than is required for threshold when the source is held against the mastoid process of the observer.

By this method threshold intensities have been determined before and after removal of the lenticular process of the incus. For 256 and 512 cycles the bone-conduction thresholds were not impaired by this lesion of the air-conduction mechanism; but they were slightly impaired, on the average, for 1024 and 2048 cycles. These observations constitute evidence that transmission to the inner ear is primarily via an osseous rather than an osseo-tympanic pathway, at least for the lower frequencies, the ones commonly used in clinical examinations of bone-conduction acuity.

(103) *41. Changes in transplanted pituitary cells stratified in the ultracentrifuge.* M. F. Guyer and P. E. Claus, University of Wisconsin.

Basophil cells and oxyphil cells, respectively, after rotation of from 20 to 30 minutes in an ultracentrifuge with a displacement pull of about 400,000 times that of gravity, show almost opposite forms of arrangement of contents. In the one type the nucleus comes to lie at the centripetal side of the cell, in the other, at the centrifugal side. The other cell inclusions (golgi apparatus, granules, etc.) are correspondingly reversed. The recovery changes to be seen week by week in successful transplants will be described and demonstrated, as will various atypical cells, particularly ones of a colloid secretory nature, much larger in size than the colloid-secreting cells occasionally found in the pituitary.

(119) *42. A true reptilian stage in the development of the opossum erythrocyte.* G. W. D. Hamlett, Carnegie Laboratory of Embryology and the Division of Fur Resources, U. S. Biological Survey.

The earliest erythrocytes in the opossum embryo are small cells with large nuclei and relatively little cytoplasm. These are replaced by a generation with condensed, pycnotic nuclei and expanded cytoplasm. These stages are found in all mammalian embryos; they have been called, because of their supposed recapitulatory significance, the ichthyoid and sauroid stages, respectively. In placental mammals the sauroid generation gives place directly to the characteristic anucleate erythroplasts. In the opossum there is an intervening stage with spindle-shaped nucleated erythrocytes; this phase has been lost in the placentates.

The fusiform corpuscles appear about the 10 mm. stage, near the time of birth. They gradually replace the sauroid erythrocytes, until in 13 mm. embryos all the corpuscles are nucleated spindles. This stage lasts only a short time, one 14 mm. embryo already showing a few erythroplasts in the blood. The oldest embryo showing fusiform cells was one of 17 mm.; after this stage only erythroplasts are found.

Since the fusiform corpuscles are more reptilian in form than the 'sauroid' cells, it is suggested that interpretation of the latter as a recapitulatory reminiscence of the reptilian stage in mammalian evolution is erroneous. If any such reptilian stage exists in the development of the blood cells it is represented by the fusiform cells of the opossum. This stage has been lost in the placentates; the 'sauroid' cells are merely an embryonic phase.

(98) *43. Artificial rupture of the graafian follicle in the rhesus monkey.* Carl G. Hartman, Department of Embryology, Carnegie Institution of Washington, Baltimore.

In the course of routine rectal bimanual palpation of monkeys to ascertain the time of ovulation, the ovarian follicle burst under the palpating finger on a number of occasions. Five examples are given: ♀ no. 157: November 13, 1933 (day 12 of cycle); placed with male at once; the egg was fertilized, embryo removed surgically 26 days later. ♀ no. 324: December 10, 1935 (day 9); mated at once; December 14, uterus flushed through to secure egg, egg not found; December 16, laparotomy, corroborating ovulation. ♀ no. 324 again: January 7, 1936 (again on day 9); mated at once; January 18, ovulation corroborated by laparotomy, endometrium biopsied, egg not found. ♀ no. 305: January 17, 1935 (day 21), follicle burst under finger with explosive force; mated at once; January 28th (day 3 of succeeding cycle) ovary removed, uterus biopsied; rupture line was found to be a mere slit no corpus luteum had developed endometrium was of interval type. ♀ no. 305 again; December 2, 1935 (day 8 of cycle!); ovulation confirmed by laparotomy next day—a long tear in follicle with herniated granulosa; December 12 biopsy of corpus luteum and endometrium, both early pregravid. A corpus luteum failed to form only in the case of the late rupture of the follicle (day 21).

(62) *44. The origin of the yolk sac in the rhesus monkey.* Chester H. Heuser, Carnegie Embryological Laboratory, Baltimore.

A blastocyst of the monkey found free in the uterine cavity 9 days after mating is a thin-walled sphere 0.27 mm. in diameter. It is composed of 370 cells, 314 of which are trophoblastic cells, thirty-two formative cells and twenty-four undifferentiated cells which have been delaminated from the formative mass.

The undifferentiated cells are destined to take part later both in the formation of the yolk sac and of a sheet of cells which lines the inner surface of the trophoblast. The layer so formed may be referred to as the coelomic membrane. Its growth has been traced in a closely graded series of stages and has been found to be complete on the twelfth day. This layer may arise by over-growth of the cells which first delaminate from the formative mass or from the trophoblast. The yolk sac is not seen until the twelfth day and is much smaller than the germ disk to which it is closely applied. The dorsal wall is a layer 2 or more cells thick whereas the distal pole is composed of flattened cells. The entire embryo and yolk sac are walled off from the cavity of the chorion by the coelomic membrane.

(126) *45. The cytologic response of the peritoneal fluid to certain substances.* George M. Higgins, Sam F. Seeley and Frank C. Mann, Division of Experimental Medicine, The Mayo Foundation, Rochester, Minnesota.

The introduction of certain substances into the peritoneal space is known to produce an exudate consisting of serum, leucocytes, fibrin and other materials of unknown identity. Recently clinical use has been made of this reaction to attempt to immunize the peritoneum by the preoperative introduction of some stimulating agent.

This report covers a study of the cellular response, in the peritoneal cavity of white rats, to certain substances introduced intraperitoneally. Sterile water, 0.85 per cent sodium chloride, egg albumin, horse serum, amniotic fluid concentrate, anti-peritonitis vaccine and 2 per cent sodium ricinoleate were used. The percentage distribution of the exudative cells and the total number for each cubic millimeter of fluid were determined at intervals of 1, 3, 6, 12, 24, 48 and 72 hours, and at 7, 14 and 21 days following injection. Fluid for differential and total counts was obtained by inserting a small capillary glass pipette directly through the anterior wall. Total free fluid in the peritoneal cavity was determined by absorbing all fluid upon filter paper of known weight; then the increase in the weight of the paper was accepted as the weight of fluid present. Thus an estimate was made of the total number of cells present in the peritoneal space at each interval following the injection. The greatest stimulation was induced by sodium ricinoleate, less by the vaccine and amniotic fluid.

(123) *46. On the origin of thymocytes in Salmo fario.* Benjamin H. Hill, Department of Anatomy, College of Dentistry, New York University. (Introduced by Margaret M. Hoskins.)

Lymphoblasts are found in the border of the epithelial thymus primordium in conditions which show that they have immigrated from mesenchyme. No other origin of lymphoblastoid cells in the thymus was found. The lymphoblasts become reduced in size to form thymocytes, which are true lymphocytes. (See demonstration no. D28.)

(16) *47. Maintenance of accessory organs by ovarian grafts in castrate male mice.* R. T. Hill and W. U. Gardner, Yale University School of Medicine.

Four 40- to 50-day-old castrate male mice received, at the time of castration, subcutaneous ear grafts of ovaries from females of the same strain. Three males received similar grafts at 57 days after castration. The animals were killed from 135 to 195 days later. In three the seminal vesicles and prostates were found to be within the size limits of normal variation. The accessories of the others were of typical castrate type. Strong's inbred mice were used.

In the three cases which responded, the accessories contained moderate to large amounts of secretion, and displayed normal epithelial linings. The ovarian grafts in these cases showed a few small follicles (none in one case) and a relatively large percentage of the graft was made up of small clusters of cells which appeared much like lutein cells. Some atretic corpora lutea were present. The grafts in the non-responsive cases showed the presence of many more large follicles, and only small amounts of lutein-like tissue.

These results open several possibilities: 1) progesterone may be the substance responsible, 2) a balance between progesterone and estrone may be needed, 3) one or both of these hormones may, under certain conditions, produce male hormone reactions, 4) androsterone may, in some cases, be elaborated by an ovarian graft.

Injections of ovarian hormones are being tried to test these possibilities.

(97) *48. Ovulation in the rabbit (mechanisms involved).* Joseph C. Hinsey, Department of Anatomy, Stanford University.

Observations of ovaries in situ, through a glass window in the lateral abdominal wall, or in transplants into the anterior chamber of the eye show the following events. On the surface of a well-vascularized follicle there appears an avascular spot, surrounded by dilated blood vessels. This avascular spot develops into a papilla, the tip of which opens and the contents of the follicle flow slowly out of the opening. The avascular spot appears before the papilla protrudes noticeably above the surface, thus before there has been any considerable stretching of the ovarian wall. Its formation may be explained either by local pressure upon the vessels or a vasoconstriction of the vessels in this region.

Regardless of what produces an increase in intra-follicular pressure, whether it is by action of smooth muscle or a gradual secretion of follicular liquor, there is a change in the wall of the ovary so that the portion of it which forms the stigma is actually removed when rupture starts. This statement is based upon observations from graphic reconstructions of ninety rupture points and from other three-dimensional reconstructions.

Vascular changes and other events of ovulation show no observable variations in animals in which ovarian connections with the central nervous system were completely severed, or in ones which had been hypophysectomized 2 or 3 hours before the injection of pregnancy urine.

(9) *49. Regeneration of testis in the White Leghorn fowl.* Charles W. Hooker, Department of Medicine, Duke University School of Medicine. (Introduced by F. H. Swett.)

In birds, regeneration of testis from a fragment left at castration occurs within a month after operation as shown by comb growth. In seven chickens, however, 6 months to 3 years elapsed between castration and the onset of comb growth. In each of these cases exploratory operation or necropsy revealed testis, retroperitoneal in position, whereas testis regenerated from a fragment is always pendent in the body cavity. In one of these seven animals the extirpation of a 10-mg. mass of testis was followed by immediate regression of a large comb. The long period of time during which these cases showed no comb growth indicates complete testis removal at the original operation. This interpretation is supported by the fact that careful study in four cases revealed the originally excised testes to be unbroken. Histologically, testis regenerated from a fragment differs in no way from normal testis or from testis grafts, whereas testes formed de novo show tubules and cords in all stages of development and degeneration. In some of these gonads cords are being proliferated from the peritoneum, and occasionally toward the center of the testis mature spermatozoa are found. These findings are interpreted as evidence that the peritoneal epithelium, in the adult bird, can give rise to gonad and that germ cells can arise from somatic cells.

(59) *50. Split axones as a cause of facial tic following injury to the seventh nerve.* Howard A. Howe and Sarah S. Tower, Department of Anatomy, Johns Hopkins University.

In a series of rhesus monkeys one facial nerve was injured in various ways to produce paralysis of the facial muscles. As function returned the more or

less discrete movements of platysma, and the muscles of the mouth, nose, eye, and ear were found to be fused into mass contractions involving several, or even all of these groups. In most cases the rhythm of these contractions was the same as that of eyelid closure, but there were also frequent slower movements in time with dilation of the nares during respiration, or synchronized with the contraction of the mouth and platysma in chewing and emptying the cheek pouches. The basis of this phenomenon was found to be a splitting of regenerating axones near the point of injury, the degree of mass contraction being proportional to the amount of damage to the nerve. These tic-like movements showed no tendency to regression over a 3-year period. They were thought to be analogous to facial tics observed in man following seventh nerve injuries. On the normal side there was also observed a tendency for a single axone to supply more than one muscle. These latter, however, were always contiguous and the normal side never exhibited the widespread splitting of axones so characteristic of the injured nerve.

(75) *51. Phylogeny of the distal musculature of the pectoral appendage.* A. Brazier Howell, Department of Anatomy, Johns Hopkins University.

The musculature of forearm and manus basically is divisible into dorsal matrix and ventral matrix of elbow, and dorsal matrix and ventral matrix of the podium. The former contribute to the present musculature of brachium and antibrachium, and the latter to the musculature of antibrachium and podium. The forearm muscles of the former category are divisible into humero-radial (carpi radialis), humero-podial (digitorum communis et sublimis), and humero-ulnar (carpi ulnaris) components. The deep muscles of the forearm (mm. abductor pollicis longus, extensor pollicis longus, extensor indicis proprius; flexores digitorum profundus et pollicis longus) have been derived from podial matrices that have migrated proximally along the ulna. The short flexors of the hand have been derived from a superficial and a deep basic series: from the former have come mm. palmaris brevis, abductor pollicis brevis, superficial head of flexor pollicis brevis, abductor et flexor digiti 5, and lumbricales. From the deep series have been derived mm. contrahentes (including adductor pollicis), interossei, opponens pollicis, deep head of flexor pollicis brevis, and opponens digiti 5.

(54) *52. A mammalian (cat) representative of the paragriseal cells previously described in avian spinal cord.* John Franklin Huber, Department of Anatomy, University of Michigan. (Introduced by Elizabeth C. Crosby.)

The spinal cord of the cat has a distinct marginal paragriseal column of cells. Other mammalian material examined (mouse, albino rat, guinea pig, dog, macaque and man) showed only very occasional questioned cells which might represent the large number of paragriseal cells which the author has previously reported in the spinal cord of the pigeon as forming a marginal paragriseal column and a group of scattered paragriseal cells. The spinal cords of other birds (chicken, duck and parrakeet) have paragriseal cells present in a pattern similar to that in the pigeon.

(32) *53. The relation of the hippocampal vestiges and their related fiber connections to the corpus callosum in the bat.* Tryphena Humphrey, Department of Anatomy, University of Michigan. (Introduced by Elizabeth C. Crosby.)

Hippocampal vestiges surround the corpus callosum just as completely as the hippocampal commissure is surrounded by the supra-, infra-, pre-, and postcommissural parts of its bed nucleus, also a hippocampal vestige. The anterior hippocampal cortex is united with Ammon's horn by the induseum griseum along the dorsal surface of the corpus callosum, and with the bed nucleus of the hippocampal commissure by the septo-hippocampal nucleus along its ventral surface. Cells of the septo-hippocampal nucleus extend dorsalward into the corpus callosum, even crossing it caudalward where the two commissures join. The supracommissural part of the bed nucleus of the hippocampal commissure, which usually caps this region of junction, is united with the gyrus dentatus by a single row of cells.

Fibers extend between the gyrus dentatus (and the supracommissural part of the bed nucleus) and the anterior hippocampal cortex, passing dorsal (stria of Lancisius) and ventral (perforating fibers) to the corpus callosum. Some of both perforating and stria fibers also reach the septum and join the postcommissural fornix.

These cell and fiber relations suggest that fibers which form the corpus callosum, as well as those which form the hippocampal commissure, grow through the primordial hippocampus, leaving the more dorsal portion serving as a primitive forward continuation of Ammon's horn, and the more ventral portion as a similar undifferentiated continuation of the gyrus dentatus.

(60) *54. The determination of dynamic factors in the neurulation of Amblystoma punctatum.* Cranford Hutchinson, The Morris Biological Farm of The Wistar Institute. (Introduced by M. J. Greenman.)

During gastrulation the presumptive neural tissue elongates to form the medullary plate. Pieces of this tissue were rotated 90° in order to ascertain the stage when the direction of this elongation is determined. Pieces rotated at the beginning or middle of gastrulation (Harrison's stages 10 and 11) stretch in harmony with the rest of the medullary tissue (i.e., ortsgemass). Pieces rotated at stage 12 may or may not develop ortsgemass. Pieces rotated at stage 13 always stretch according to their original orientation, i.e., they start to elongate at right angles to the rest of the medullary plate, though their elongation is somewhat modified by the movements of the surrounding host tissue. These experiments indicate that the prospective medullary plate tissue is determined to stretch in a certain direction at the close of gastrulation. When neurulation is atypical, regulation of the nervous system is usually complete by tail bud stages.

During closure of the neural tube, pieces of the medullary tissue which have been rotated 90° or 180° prior to stage 14 show no tendency to fold disharmoniously with the rest of the medullary plate, though they close more slowly than the rest of the plate. Pieces rotated 90° or 180° at late stage 14 or stage 15 fold disharmoniously with the plate indicating that the direction of folding is determined at stage 14.

(154) *55. Studies on human placentation in the presence of a deficient decidual reaction (Placenta accreta).* Frederick C. Irving and Arthur T. Hertig, Departments of Obstetrics and Pathology, Harvard Medical School. (Introduced by G. B. Wislocki.)

A series of eight uteri from pregnancies of 16 to 40 weeks were studied by means of various connective tissue stains. At term, the main placental septa (between cotyledons) are composed of varying proportions of smooth muscle from the uterus and trophoblast from the attached villi. Large blood sinuses are present at the base of the septa within the myometrial portion. The presence of myometrium in these structures indicates that the placental septa are formed, in part at least, by the tissue to which the placenta is attached. In normal implantation, of course, this is decidua and hence the term decidual septum appears to be a justifiable one.

The fibrin layer of Nitabuch is deficient in these deciduae-poor implantation sites, and when present in its formative stages is associated with focal islands of compact decidua in contact with trophoblast. At term, there are small islands of hyaline or fibrinoid material (probably manifestations of a deficient Nitabuch's stria) scattered throughout the broad layer of trophoblast which is intimately fused with the underlying myometrium. The latter, just beneath the trophoblast, contains large vascular sinuses which would normally occupy the spongy decidua.

(108) *56. The ovaries of the bat after injection of hypophyseal extract.* Katharine R. Jeffers and Mary J. Guthrie, Department of Zoölogy, University of Missouri.

Bats receiving intra-peritoneal injections of 0.1 cc. of pituitary extract for three successive days ovulated, if at all, within 4 days from the time of the first injection. Bats that had been in captivity for more than 12 days did not ovulate, but luteinization of follicles was rare. Myotis grisescens, M. lucifugus, and M. sodalis were the species used. Dr. J. B. Collip kindly provided the extract, which assayed slightly less than 0.1 cc. for a day rat unit of maturity factor. The first date of induced ovulations was December 12th. Other individuals were injected during January and February. Development did not follow ovulation in many cases. In addition to conditioning the final differentiation and rupture of the single vesicular follicle which is characteristic of the ovaries of the hibernating bat, the extract used brought intermediate follicles to the vesicular stage and had a striking effect in increasing the number of primary follicles. Measurements and counts of the follicular population have been compared with the norms for the period covered.

(70) *57. Correlation of stages of development with critical periods of irradiation.* T. T. Job and Antone Remich, Department of Anatomy, Loyola University School of Medicine.

A very important and a very difficult phase of this problem is correct timing of insemination. Various methods have been combined in order to gain a fair degree of accuracy.

Several specimens from different litters ranging in development from 9 to 14 days inclusively, have been serially sectioned. The average stage of development

for each of these days has been determined. For the immediate problem it can be said that the critical time of irradiation, previously reported, precedes the microscopical appearance of the anlage of the brain, eye or jaw by about 24 hours. This represents the so-called latent period, a knowledge of which is necessary in order to know when other organs may be susceptible. Whether the effect of irradiation is immediate or latent is not shown by these experiments. It would appear that a given dose of x-rays, qualitatively and quantitatively, has different effects upon different structures, since in the case of the brain defect the end result is increased cell activity, in the case of the eye, cell destruction and for the jaw maladjustment of cell multiplication. Body formation is complete on the fourteenth day, so this marks the end of the period of the embryo.

(78) *58. A new method of obtaining an index of heart output.* Sydney E. Johnson, Department of Anatomy, University of Louisville School of Medicine.

Bardeen, Eyster and Meek have made considerable progress in measuring heart volume and beat output by means of Roentgen rays. Roentgenkymography offers a simpler method of applying x-rays to this problem, and has other distinct advantages. In either method the use of the term *heart output* is inaccurate, as all Roentgen methods are alike in that they show changes in size or movement of the pump, not the actual amount of blood delivered to the circulation. We have chosen to designate our product the *roentgenkymographic heart index.* In the absence of valvular and certain other defects this index parallels beat output as obtained by the dye injection method of heart output determination.

(31) *59. Effects of stimulation of points in the interior of the forebrain and midbrain on the respiratory rhythm.* Herman Kabat, Department of Anatomy, Northwestern University Medical School. (Introduced by L. B. Arey.)

Numerous points in the forebrain and midbrain of the cat were stimulated by means of electrodes oriented with the Horsley-Clarke instrument. Each point was localized by the study of microscopic sections. Respiration was recorded on a kymograph.

A sharply localized pathway, stimulation of which resulted in a marked increase in both rate and amplitude of respiration, was traced caudally from the hypothalamus. This responsive mechanism included the subfornical component of the medial forebrain bundle, nucleus supraopticus diffusus, lateral hypothalamic area, supramammillary commissure, periventricular fibers, central gray around the aqueduct, and portions of the tegmentum. Stimulation of portions of this pathway, such as the region of the supraoptic commissures, the central gray and parts of the tegmentum provoked spitting, a mimetic response resembling rage. In other experiments, points yielding a rise in blood pressure, dilatation of the pupils, etc. showed a similar localization.

Accelerated and often shallower respiration was observed during stimulation of the medial part of the internal capsule, the subthalamus, substantia nigra, central gray, and the medial region of the tegmentum.

Points which yielded a decrease in both rate and amplitude of respiration were localized in the internal capsule, reticular nucleus of the thalamus, parts of subthalamus and tegmentum, the medial region of the telencephalon, as well as portions of the rhinencephalon, such as the septum pellucidum, anterior commissure, and habenulo-peduncular tract.

(117) *60. An interpretation of the secondary lymphoid nodule in lymph nodes of the albino rat.* James E. Kindred, Laboratory of Histology and Embryology, University of Virgina Medical School.

The secondary nodules of submaxillary, inguinal and mesenteric lymph nodes of the albino rat are located peripherally in the cortex. They may be ovoid or spherical in shape and variable in size. The nodule conforms in structure to the recent descriptions of Röhlich ('33) and its peripheral mantle of small lymphocytes encloses a central mass roughly divided into two zones, a light zone lying toward the surface of the node and a dark zone lying at the medullary pole. Statistical analysis of mitotic rate and histologic characteristics of nodules and other parts of the nodes in eight 75-day-old rats from the same litter, show the mitotic rates per 1000 cells (with variance of the mean) in the dark zone: submaxillary 31(2.3), inguinal 32(2.4) and mesenteric 30(2.5); in the light zone: submaxillary 6.3(0.3), inguinal 6.7(0.4) and mesenteric 6.0(0.4). In the cortex outside the nodules mitoses are negligible while in the medulla the mitotic rates are: submaxillary 5.8(0.2), inguinal 12(4.5) and mesenteric 14(1.0). Thus the dark zone of the secondary nodule is regarded as a germinal center since it has a significantly higher rate of mitosis than the light zone and the remainder of the node. The light zone, on the other hand, shows a statistically significant higher incidence of macrophages with nuclear debris than any other parts of the node. The rates per 1000 cells are: a) light zone, submaxillary 46(2.6), inguinal 39(4.5), mesenteric 52(6.3); b) dark zone, submaxillary 26(1.3), inguinal 33(3.5), mesenteric 35(2.5). Hence if cell destruction is regarded as an indication of reaction to noxious products, the light part of the nodule may be presumed to be the essential reaction center, although the dark part may also be reactive. (See demonstration no. D32.)

(118) *61. Factors in the control of Romanowsky staining.* D. M. Kingsley, Department of Anatomy, Louisiana State University Medical Center and Northwestern University Medical School. (Introduced by B. I. Burns.)

The various types of Romanowsky stains used for smears and sections often give results unsatisfactory for a given purpose. Analysis of the cause for such poor stains is impossible when several unknown factors are simultaneously present. Indeed, even which dyes must be present to get typical staining effects is still uncertain. The role of any single dye in the production of the final effect remains questionable; and the part played by the solvent in the staining process has never been investigated systematically.

Development of a simple stain in which every constituent is controllable allowed experimentation with one variable at a time. The following factors were dealt with: dyes necessary, solvent composition, fixation, and time of staining.

The four dyes used in MacNeal's tetrachrome stain are essential. Each has a definite role in the production of a given color in the nucleus or cytoplasm.

The solvent into which these are put must contain a minimum amount of water, as well as fluids which will dissolve the dyes. "Acetone is useful. Changes in the pH of the solvent over a considerable range produce only unimportant effects in the final stain. The time necessary for good results is dependent on the dye concentration and solvent.

Utilization of knowledge of the relationship of each constituent to the final effect on the cells permits successful modification of stains with undesirable actions.

(120) *62. Clotting in the intact umbilical vein.* Joseph Krafka, Jr., Department of Histology and Embryology, University of Georgia, School of Medicine.

A study of the progressive formation of clot in the intact umbilical vein has been made in an effort to correlate 1) delayed clotting time, 2) the 10-day bilirubinemia in the newborn, 3) time of closure of the fetal channels, 4) time of the dropping of the cord. Small mural clots of the hyaline variety form slowly in the umbilical vein. They show no fibrin. Platelets accumulate in apposition to the endothelium and adhere firmly to the vessel wall. Erythrocytes are not incorporated in the clots.

These observations indicate a protective mechanism which provides against thrombus formation and embolism during the period previous to closure of the fetal channels and the dropping of the cord. That such emboli would be significant and could be liberated from the umbilical vein is shown by their occurrence when infection of the cord exists.

This opinion is in further accord with the general observation that extravasation and hemorrhage in the newborn fails to result in organized fibrinous clots.

(152) *63. Vascular changes occurring in deciduomata produced in the rat by electrical stimulation.* Robert Krehbiel, Department of Anatomy, College of Medicine, University of Illinois. (Introduced by O. F. Kampmeier.)

Momentary stimulations with a weak electrical charge produce deciduomata in which morphological distribution and time sequence approximate normal gestation to a greater degree than in mechanically produced deciduomata.

Early in the sixth day (after copulation) capillaries form a prominent subepithelial zone at the antimesometrial surface of the lumen in the sites of stimulation. During the seventh day this zone expands along the sides of the lumen to become continuous with the mesometrial sinusoids. At the start of the eighth day the subepithelial vascular zone encircles the lumen and is different from normal pregnancy only in that the surface epithelium is intact. As in pregnancy the characteristic distribution of the mesometrial sinusoids is attained by the ninth day. Concomitantly, sections of the mesometrial portion of the surface epithelium are lost. In these areas sinusoids are opened allowing extravasation into the lumen. After intravital injection of colloidal mercuric sulfide, blood containing the sulfide is found in the lumen. Thus, the extravasation is not brought about by the action of the trophoblast and in these deciduomata is not due to the technical procedure. It must be regarded as a feature of uterine differentiation which occurs at a definite stage in the development of the decidua. While it is probably an adaptation for furnishing certain nutrient substances for the embryo it occurs whether the embryo is present or not.

(34) *64. The ontogenetic development of the diencephalic centers in a bird's brain (chick) and comparison with the reptilian and mammalian diencephalon.* Hartwig Kuhlenbeck, Department of Anatomy, University of Pennsylvania. (Introduced by E. R. Clark.)

The avian diencephalon shows during early development very clearly the four longitudinal zones epithalamus, thalamus dorsalis, thalamus ventralis and hypothalamus as well as the corresponding limiting sulci, sulcus diencephalicus dorsalis, sulcus diencephalicus medius and sulcus diencephalicus ventralis. The subsequent differentiation of nuclear masses within these longitudinal zones shows in the initial stages a remarkable similarity to the conditions in reptiles. The development of nuclei is analyzed in relation to the diencephalic zonal system. Fiber connections are considered as far as the material prepared for nuclear study permitted. Corresponding to the nuclear masses of the medial geniculate body in reptiles recently investigated and described by Papez homologous avian nuclei are described as a ventral medial geniculate belonging to the thalamus ventralis and as a dorsal medial geniculate belonging to the thalamus dorsalis. The reptilian homologues of most avian diencephalic nuclei can be traced with a reasonable degree of certainty. The probable mammalian homologues of avian diencephalic nuclei are discussed by indirect comparison, taking the reptilian homologues as a basis.

(7) *65. Control of micturition by the central nervous system.* Orthello R. Langworthy, Johns Hopkins University.

The bladder musculature has been chosen as an example of smooth muscle in which to study changes of activity produced by lesions of the central nervous system both in experimental animals and patients. Information concerning activity of the sphincters was obtained only indirectly. An air-water recording system was used. Section of the posterior sacral roots caused a progressive enlargement of the bladder which never emptied afterward except by overflow. Small, rhythmical waves of contraction appeared after section of the anterior and posterior sacral roots. The vesical capacity was small after bilateral injury of the cortico-spinal tracts due to hyperactive stretch reflexes. Injury both of the cortico-spinal tracts and the pathways from the mid-brain controlling tone caused large, unsustained contractions. There was always a residuum of urine. Injury of the cerebellum or its pathways produced increased vesical volume and low resting pressures. In patients with basal ganglia lesions due to chronic encephalitis, the resting intravesical pressure was high, and the vesical capacity small. Injury of certain groups of cells and fibers in the nervous system produces characteristic changes in the tone and contraction of bladder muscle.

(113) *66. Parental instinct in the mouse, especially after hypophysectomy.* C. P. Leblond and W. O. Nelson, Department of Anatomy, Yale University School of Medicine.

Parental instinct in the mouse is characterized by three prominent features: 1) retrieving of the young, 2) nest building, 3) and care of the young (licking and covering). A slight but definite appearance of these patterns of instinct

is usually observed at puberty in the male and in the female. The presence of young induces a marked increase of the parental instinct in both sexes; after such a stimulation 88 per cent of the males exhibit parental behavior.

As is known, a strong increase of parental instinct occurs at the first parturition. At the end of the lactation period the parental instinct decreases only slightly, and the increase at the time of other parturitions is not always clear.

When lactating females are hypophysectomized the mammary glands undergo involution, but parental instinct is not suppressed. A variable diminution is observed after the operation, but the recovery is accompanied by a return of parental behavior sometimes as marked as before the operation.

These observations are not in opposition to the theory of Riddle, Lahr and Bates on the determination of parental instinct by prolactin. The induction, but not necessarily the maintenance of parental instinct, may be dependent upon hormonal factors. These experiments show that, in the mouse at least, lactation and parental instinct may be independent and that other factors probably extrahormonal (nervous mechanism?) may be involved.

(72) *67. Eyedness and handedness in 700 young children.* Paul E. Lineback, Department of Micro-anatomy, Emory University.

For studying the most natural condition of eyedness and handedness, those at a stage before receiving special training in visual acuity and manual exactness provide more promising subjects than adults.

In this present survey children in the kindergarten provided about one-third of the subjects, first and second graders another third, and third and fourth graders the last third. The majority were within the age limits of 5 to 7 years.

A simple but effective equipment was used and a procedure was followed which was adjusted to the clear understanding of the subjects. Their response was natural but they were unaware of being examined seriously. The results, therefore, are assumed to be as correct and reliable as any obtained through other methods.

From these tests there might be formulated four groups of eye-hand functioning, the right eye and hand group, the left eye and hand group, the left eye and right hand group, and the right eye and left hand group. Of those examined, the majority, 51 per cent, were in the right eye and hand group, 27 per cent were in the left eye and right hand group, and only 9 per cent were in the left eye and left hand group; 13 per cent were in the right eye and left hand group.

(76) *68. A note on muscles causing motion of ulna during rotation of forearm.* Frederic P. Lord, Department of Anatomy, Dartmouth Medical School.

Sidewise motion of the ulna in rotation of the forearm is a clinical fact, and involves a small amount of motion in its ginglymus joint. Combined with flexion and extension this sidewise motion causes the ulnar head to describe the arc of a circle, but allows no motion about its long axis. This motion is mentioned in the literature but its cause is incompletely explained.

In pronation the anconeus, as seen by the direction of its fibers, should both extend and abduct the ulna. Clinically it can be felt easily in contraction, effecting these motions during pronation. No muscle has been credited, to my knowledge, as its direct antagonist in sidewise motion.

Analysis of the lacertus fibrosus of the biceps shows that, after winding around the flexor group of muscles, it is practically inserted into the ulna close to the anconeus and that its fibers are so directed as to have an adducting component, thus making this muscle a direct antagonist in lateral motion to the anconeus. Clinical examination also proves that the lacertus acts during supination. This evidence suggests that in rotation of the forearm there is a synergistic action of the anconeus and lacertus fibrosus with the regular pronators and supinators of the forearm, which is responsible for the apparent rotation of the ulna.

(111) *69. Hormonal requirements for lactation in male rabbits.* W. R. Lyons, Division of Anatomy, University of California.

To say that lactation may occur without progesterone need not imply that that hormone has no place in mammary physiology. But it becomes difficult to differentiate the specific role of progesterone, when one observes that males respond to a series of estrin injections, followed by mammotropin, by lactating from secretory units indistinguishable from those of normal lactation.

Three weeks' treatment of young male rabbits with 10 rat units of estrin daily caused mitotic proliferation of the rudimentary duct system. Solid outgrowths from ducts became canalized by liquefaction and desquamation of the inner cells. Small alveoli developed along the ducts, and sometimes formed small lobules. Such glands were distended with a clear, serous, cell-containing fluid.

Following this treatment, and within a day of the first injection of half a million 'local' squab units of mammotropin, milk could be expressed from the nipples of these males. Biopsy showed that alveolar epithelium was proliferating as well as secreting milk. At the end of a week of similar daily injections, greatly enlarged, conglomerate alveoli had formed lobules such as are seen in normal lactation.

The histology of these lactating mammary glands was similar to that repeatedly observed in mature, non-ovulated, ovariectomized rabbits, responding to mammotropin by functional alveolar growth. It seems unnecessary to have recourse to the idea of 'duct lactation' to explain the milk in these glands.

(2) *70. The origin of the lungs in the opossum.* Edward McCrady, Jr., The Wistar Institute of Anatomy.

The lung rudiments arise at stage 24 when the medullary plate is flat. Viewed from the ventral side the endoderm anterior to the somites shows three longitudinal depressions: a medial notochordal groove, and two lateral branchial furrows. Each branchial furrow touches the ectoderm at two points—the closing plates of the first and second branchial pouches. Posteriorly the furrow becomes shallower and the pleuropericardial cavity is inserted between its lateral half and the ectoderm. At the level of the umbilical vein the mesodermal blastema of the lung is recognizable. At stage 25 the branchial furrow has markedly deepened at this level. At stage 27 the pleura covers the lung pouch completely, interposing coelom between it and ectoderm. The concrescence of the hearts has moved the anterior intestinal portal caudad until it has passed beneath the lungs. A cross section thus shows the latter at the dorsolateral corners of a triangular pharynx, the ventral apex being between the sinuses. The concrescence of the

sinuses eliminates this apex at this level so that the lungs become secondarily ventrolateral. Anteriorly the ventral groove persists as the laryngotracheal groove, which is secondarily associated with the lungs. This evidence plus the fact that the pulmonary arteries and nerves are typically branchial in origin seems strong support for the theory originally advanced by Goette that the lungs are modified gill pouches.

(5) *71. Menstruation in intra-ocular endometrial transplants in Macaca mulatta.* J. E. Markee, Department of Anatomy, Stanford University, and the Carnegie Institution of Washington, Department of Embryology.

Menstruation was studied microscopically in intra-ocular endometrial transplants in over 300 cycles. The following sequence of events occurs in both ovulatory and anovulatory cycles, following castration, after injections of oestrin, and after spinal transection. The superficial two-thirds of the transplant, supplied by the coiled arteries, becomes completely anemic. Four to 24 hours later, circulation temporarily resumes in single arterial fields (the remainder of the transplant remaining anemic) and almost immediately blood escapes either from a capillary or an arteriole. It usually escapes from only one point and a hematoma may form. Occasionally it oozes for a short distance along one of these vessels, in which case a hematoma forms more slowly. Hematomata resulting from rupture of a vessel form and begin to discharge in 1 to 25 minutes, while those formed by diapedesis may persist for 36 hours. There is an occasional reflux of blood from a vein whose capillary bed is either constricted or destroyed. Single hemorrhages last from 6 seconds to 20 minutes. They are arrested by contraction of the appropriate coiled artery or its branch. Blood from these primary hemorrhages seldom clots. Fright at this stage causes, within 15 to 25 seconds, reopening of the arteriole, which for 5 to 15 reconds delivers blood that promptly clots. In many cycles congestion and nearly complete stasis precede the anemic stage by 2 to 4 days.

(50) *72. Accommodation and its neuronal reflex pathways in the teleosts.* Ralph G. Meader, Department of Anatomy, Section of Neuro-anatomy, Yale University.

Information from the literature correlated with neuro-anatomical studies suggests that the elements of the accommodative reflex are as follows:

1. Sensory stimuli arise from the temporal (caudal) portion of the retina upon which is thrown an inaccurately focussed image of an object in the nasal (frontal) visual field. In this field only are distant objects susceptible of accurate focussing because of the character and orientation of the accommodative mechanism. The stimuli are transmitted by the optic nerve to the contralateral corpus geniculatum which receives optic fibers solely from the temporal portion of the retina.

2. Integration of the stimuli occurs in the corpus geniculatum which corresponds in degree of elaboration with the degree of accommodative ability. It is absent or small in blind fish and those which accommodate poorly, large in fish which accommodate well. Connection of the corpus geniculatum with the motor outflow is established by fibers which reach the contralteral oculomotor nucleus via the posterior commissure and the medial (posterior) longitudinal fasciculus.

3. Preganglionic fibers from cells in the oculomotor nucleus pass out with the oculomotor nerve to terminate in the ciliary ganglion. Postganglionic fibers traverse the short ciliary nerve and its muscular ramus to innervate the retractor lentis muscle or campanula Halleri. Adequate response of the muscle shifts the position of the approximately spherical lens until a sharp image is focussed upon the temporal retina.

(28) *73. Influence of the cerebral cortex upon the cardiovascular system.* Cecilia C. Mettler, W. F. Hamilton, Lane Allen, R. A. Woodbury and Fred A. Mettler, Department of Anatomy, and Department of Physiology and Pharmacology, University of Georgia School of Medicine.

Stimulation of the cerebral cortex within or near the motor area produces normally an increase in cardiac rate, a rise in blood pressure and then a slowing in cardiac rate. This is usually accompanied by epileptiform seizures. Curarization eliminates the seizures but not the cardiovascular response. Vagotomy eliminates the postpressor slowing of the heart but does not eliminate the cardiac acceleration and pressor effects. Severance of the spinal cord between C IV and C V eliminates the cardiac acceleration and pressor effect which are replaced by cardiac slowing upon cortical stimulation. Stimulation of the dura or points well removed from the motor area do not produce these specific autonomic effects. These results confirm the results of Francois-Franck, et al. (1874).

Ablation of the anterior portion of the cortex changes the cardio-vascular reactions to epinephrine and acetylcholine rendering the system less sensitive to epinephrine and more sensitive to acetylcholine. The change in cardiovascular reactions to these drugs persists for long periods after ablation. (Tests so far have been run 84 days.) (See demonstration no. D37.)

(124) *74. Variations in the blood supply of the spleen.* Nicholas A. Michels, Department of Anatomy, Jefferson Medical College.

In thirty-eight cadaver dissections the number of arteries entering the spleen varies from five to twenty-two, common numbers being seven to ten. Generally the splenic artery divides into a larger arteria terminalis superior and into a smaller arteria terminalis inferior. Both give off ultimate branches which may be few or numerous (two to five), short or long (1 to 10 mm.), small or large (0.5 to 3 mm.). The rami lienales may arise early (distributed type) or late (bipodal) from the splenic trunk. Polar arteries are common. The arteria polaris superior may arise from the coeliac axis (double splenic artery), the splenic trunk or its terminal branches. The inferior polar arteries, much more numerous and varied, may arise from the splenic trunk, its primary branches or left gastro-epiploic, the latter artery having the most varied connections with the spleen. Variations exist between the distributed and compact (bipodal) type of vascularization. The terminal divisional patterns are intimately correlated and co-extensive with the morphological variations of the medial surface of the spleen. The hilus may be distributed or compact. Aberrant branches and polar arteries may enter the renal surface. Notched areas, tubercles, inferior thumb-like lobules and accessory spleens show a selective distribution of arterial twigs often in a plane other than that of the main vessels. The terminal and ultimate splenic branches only occasionally present transverse anastomoses. Tortuosity may be continuous or intermittent, moderate or marked, the course of the artery supra- retro- or intra-pancreatic.

(86) *75. The hypophysis of the ground squirrel (Citellus tridecemlineatus) under normal and experimental conditions.* Warren O. Nelson, Yale University School of Medicine and The University of Chicago.

Hypophyses from over 400 ground squirrels have been studied with histological and cytological techniques. The structure of the gland is similar to that of other mammals and the usual cell types are present in the anterior lobe. One or more colloid-filled cysts, lined with ciliated cuboidal epithelial cells, are usually found in the anterior lobe near its union with the pars tuberalis. A few mucous acini are sometimes found in association with these cysts.

Definite changes, which may be correlated with seasonal alterations in the reproductive organs, have been observed. The anterior lobe shows a marked increase in weight prior to and during the breeding season, which occurs in April and May. The basophiles, and less strikingly the acidophiles, increase in size, number, and degree of granulation. These changes disappear during the summer months and no significant variations have been observed throughout the autumn and early winter.

Castration, at any season, results in an increase in basophiles, but even in animals gonadectomized for many months signet ring 'castration cells' are absent. This basophilia is attended by an increase in content of gonadotropic hormone on the part of hypophyses and blood serum. Injection of gonad hormones in castrates has prevented the basophilia and, in high dosage, has induced extensive degranulation of both basophiles and acidophiles. Administration of gonadotropic hormones to normal animals, at any season, has resulted in the production of gonad hormones and the consequent occurrence of degranulatory changes in the chromophiles.

(8) *76. The function of the corpus striatum in the social behavior of fishes.* G. K. Noble, American Museum of Natural History.

In the cichlid fishes, lesions of the striatum lead to lack of coordination in the breeding behavior and often in the care of young. Different abnormalities of behavior appear at successive breedings of the same fish indicating that unlike the conditions in pigeons there is little localization of function. In the cichlids, however, part of the posterior tubercle is required for the movements of egg laying and fertilization. Defects following its removal are permanent while some deficiencies following other lesions tend to disappear on successive layings. In Betta splendens and Lebistes reticulatus with less complex mating behavior, nearly complete ablation of the forebrain inhibits but does not prevent the normal mating behavior. These unions, like those of forebrainless cichlids, are, however, sterile. Pituitary implants (frog) will induce ovulation in forebrainless cichlids but not restore the complete mating behavior.

Sex recognition is unimpaired by forebrain ablation. Forebrainless cichlids learn new nesting territories and mates. The identification of mates is accomplished by visual cues, appearance as well as behavior aiding in the process. The schooling of cichlids is permanently affected by forebrain removal. The operated fish are unable to follow the school through rapid turnings. The forebrain of fishes regulates social behavior by coordinating complex behavior patterns as well as by influencing the pituitary.

(102) *77. The general morphology of the elasmobranch hypophysis.* H. W. Norris, Department of Zoölogy, Grinnell College.

Of the three lobes of the hypophysis, the anterior lobe and the superior lobe have a fairly constant relative size, position, attachment and histological structure. The inferior lobe varies greatly in all these respects, and also varies from highly functional to rudimentary condition. Two chief types of hypophysis: selachoid (sharks) and batoid (rays). The selachoid type displays three subtypes: 1) that of the diplospondylous sharks; 2) that of the cyclospondylous sharks; 3) that of the asterospondylous sharks, the latter a miscellaneous group. Intimately associated with the hypophysis is the saccus vasculosus, the thin-walled posterior termination of the infundibulum. In some forms the saccus vasculosus is extraordinarily enlarged, in others rudimentary or vestigial. The superior lobe of the hypophysis, and in some species part or all of the anterior lobe, is attached to the ventral wall of the saccus vasculosus. This paper is based upon a study of reconstructions from serial sections of hypophyses of seventy-two species in thirty-nine genera of elasmobranchs.

(17) *78. Further experiments on the effect of prolonged injections of estrin on the epithelium of the cervix uteri of the monkey.* Milton D. Overholser and Edgar Allen, Department of Anatomy, University of Missouri, and Department of Anatomy, Yale University.

Experiments in ten more animals are reported. Five of the animals were ovariectomized, and two of these were uninjected controls receiving only cervical trauma. Five (two ovariectomized and three normal) of the eight injected animals also received cervical trauma; three animals (one ovariectomized and two normal) received injections only.

The estrin was given in oil solution, 400 R.U. three times weekly or 300 R.U. daily. The total dosage ranged from 21,800 to 73,400 R.U., given over time periods ranging from 6 months to 2 years.

In the three animals receiving the highest doses definite adenoma of the cervical glands with cystic changes and extensive epidermization were produced. In three animals receiving the lowest doses the cervical epithelium was atrophic. In the remaining two injected animals there was moderate glandular hyperplasia and epidermization. Cervical trauma had no relation to the degree of changes produced. No epidermization occurred in the endometrium of any of the uteri which showed the usual estrin response. The uninjected controls showed a very atrophic cervical epithelium with no epidermization.

Mitoses in the stratified squamous cells of the epidermization areas have not been observed. In some areas it appears that the stratified squamous cells might be arising from connective tissue cells.

The effect of the estrin injections on the ovaries, mammary glands and the other endocrine organs has been studied.

(134) *79. The development of the human lung.* Dwight M. Palmer, Department of Anatomy, Ohio State University. (Introduced by R. C. Baker.)

The work being reported has been done entirely on selected prenatal human material. An attempt has been made to follow the growth and differentiation of the original foregut diverticulum into the prenatal tracheo-bronchial tree. In human foetuses up to and including 9 weeks of age the branching anlage is lined with a pseudo-stratified epithelium. The mesenchymal condensations appearing around the end buds of the epithelial anlage in these early weeks are of no significance in the study of the problem of lung epithelium. During the growth period from the tenth to the twentieth weeks the new generations of tubules that grow out are lined with an intact simple cuboidal epithelium. The cells lining the terminal generations of tubules show a lipoidal reaction at 20 weeks. The surrounding stroma is avascular up to and including this period. During the twenty-first week there is a vascularization of the stroma that surrounds the terminal generations and the newly opened blood capillaries sprout into the immature pulmonary alveoli. These sprouting vascular loops appear to push inward between the lipoidal epithelial cells and thus present a surface nude of epithelium to the alveolar lumens.

(56) *80. Neurofibrillar development in the spinal cord of rabbit embryos (pyridin silver).* D. S. Pankratz, College of Medicine, University of Tennessee.

In 13- to 14-mm embryos the spinal nerve roots show neurofibrils, best developed in the anterior roots.

The spinal ganglion cells are bipolar. Thin laminae of neurofibrils are present in the lateral and ventral funiculi, and in the lateral part of the dorsal funiculus. A few fine fibers leave the dorsal funiculus to enter the ventral cell column. The floor plate contains some neurofibrils.

Motile embryos 33 to 34 mm. long show most of the spinal ganglion cells in the later stages of unipolar development. The ventral and dorsal roots contain numerous fibers, and the dorsal funiculus is definite. Fibers, most numerous in the lateral part, pass from the dorsal funiculus into the ventral cell column or into a dorsomedian cell group. Definite cell groups can be distinguished in the ventral cell column. Above the sacral segments the anterior white commissure is composed of fibers which come from the dorsal cell columns, or originate in small cells lateral to the central canal or large cells of the anteromedian group.

In 53- to 54-mm. embryos (highly motile) the spinal ganglion cells are unipolar. Many dark fibers can be traced from the entire dorsal funiculus to ventral column cells. The anterior white commissure is conspicuous.

Neurofibrillar development occurs in a cephalocaudad direction with exaggeration at the level of the limbs. (See demonstration no. D42.)

(11) *81. On the continuation of sexual rhythms in a woman after menopause.* George N. Papanicolaou, Department of Anatomy, Cornell University Medical College, New York City.

The continuation of 'sexual rhythms' after menopause is described in a 46-year-old woman (special case), who has been in menopause since August, 1931. Daily vaginal smears were examined since January 26, 1932. Thirteen follicular cycles have occurred. The intervals ranged from 12 to 387 days.

The sequence of stages was as follows: a) Follicular stage: vaginal smears showed leucopenia and flat cells with pyknotic nuclei; b) Bleeding stage: smear as above with many erythrocytes; c) Regressive: continued leucopenia, heavy grouping of cells; d) Premenstrual: gradual reappearance of leucocytes, enlargement of nuclei of cells; e) Menopausal or atrophic: abundance of round or oval compact (deep) cells, many leucocytes, frequent microscopic bleeding; f) Menstrual: abundance of mucus, leucocytes and erythrocytes.

These stages correspond to the following stages of the normal sex cycle (Papanicolaou, '33): a) high follicular or copulative; b) post-ovulatory bleeding; c) proliferative; d) premenstrual; e) absent; f) menstrual or congestive.

The prolongation of all stages, the almost complete suppression of the menstrual bleeding, the appearance of the menopausal stage, and the increase in the post-ovulatory type of bleeding are the most characteristic changes after menopause. Post-ovulatory bleeding was often apparent externally as a pseudo-menstrual bleeding.

Most follicular stages occurred during spring and summer. Two or three follicular stages followed by bleeding have sometimes succeeded one another.

(93) *82. Cytology of mouse leukemia in relation to differentiation of lymphocytes.* J. S. Potter, Department of Genetics, Carnegie Institution of Washington, Cold Spring Harbor. (Introduced by H. O. Jordan.)

Studies on histogenesis of spontaneous leukemia and on the cell types involved in spontaneous and transplanted leukemias in mice indicate that the amount of differentiation is correlated with differing physiological states. Morphologically the types of lymphoid cells in the leukemias do not extend beyond the range of normal types. The concentration of leukemic cells in homogeneous masses, unconfused by other cells facilitates description of complete samples of populations. Measurements made on such populations include cell size, nuclear size, nuclear-nucleolar ratio, number of mitochondria and neutral red granules, diameter of metaphase plate and per cent of cells in division. The range of values for each measurement is the same in the different populations; the differences are shown by the frequency distribution.

Direction of differentiation depends on intrinsic and environmental factors. In its optimum environment one population may be characterized by a high per cent of large young cells which reproduce themselves by dividing or become inactive through no morphological differentiation other than in cytoplasmic characters. When changed to another environment differentiation may produce a large per cent of smaller lymphoid cells with a decreased rate of proliferation. The reaction is reversible.

Evidence on the more obscure question of extra-nodular origin of lymphoid cells has been found in localized reticular cell changes occurring in pre-leukemic stages in 42 of 121 mice of the inbred strain C58, in which 90 per cent of the animals die of spontaneous leukemia. These changes are followed by the production of lymphoid cells.

(74) *83. Ossification as additional evidence in differentiating identicals and fraternals in multiple births.* Joseph W. Pryor, Laboratory of Anatomy, University of Kentucky.

The author gives the result of the study of roentgenograms of the hands of three sets of quadruplets.

The points taken into consideration are the chronological sequence of ossification of the carpal bones: The presence of an extra epiphysis at the proximal end of the second metacarpal bone; and other normal variations in ossification that may be thought to be questions of heredity.

The P— quadruplets, four boys, are fraternals. The report given by Doctor Ledbetter notes differences in mental, physical and other characters. The author finds differences in ossification in each which may be considered as evidence of fraternals.

The M— quadruplets, four girls, were reported by Doctor Clarke in The American Journal of Heredity, but ossification was not noted. He states, "The evidence therefore renders it probable that the quadruplets under consideration are identicals."

The ossification that I am reporting on these quadruplets gives positive evidence that they are identicals.

(69) *84. X-radiation and tissue dedifferentiation.* William O. Puckett, Princeton University. (Introduced by E. G. Butler.)

Previous investigations (Butler, '33 and Puckett, '36) have shown that amputated limbs of Amblystoma larvae fail to regenerate after exposure to x-radiation. Histological studies reveal that x-radiation leads to a complete dedifferentiation of all the formed structures of the limb stump. More recent studies have shown that x-radiated larvae are unable to repair injuries made on the fore limb. A complete dedifferentiation of the entire fore limb of a radiated larva may be obtained by simply inflicting a small wound on the upper arm of sufficient depth to remove a small section of the humerus. Dedifferentiation processes set in at the point of injury and spread throughout the limb, finally leading to a complete resorption of the limb. Thirty days after the date of injury all that remains of the original four-digit limb is a small digitless bud on the lateral body wall of the larva. During this period in which this extensive dedifferentiation of the limb has been taking place, the larva has continued to feed and to grow at a fairly normal rate.

Likewise, larvae exposed to x-radiation are powerless to regenerate portions of tissue removed from the tail and lower jaw. However, in these cases, the uncontrolled dedifferentiation of adjacent tissues, as described in the case of the amputated or injured fore limb does not take place. The wound heals over, the missing structures are not regenerated, but tissues around the point of injury are apparently unaffected.

(155) *85. The border zone of the 'Yale' embryo.* Elizabeth M. Ramsey, Department of Embryology, Carnegie Institution of Washington, Baltimore. (Introduced by G. L. Streeter.)

The 'Yale' specimen is an apparently normal, presomite human embryo with a blastocyst cavity of 2.17 × 1.40 × 0.61 mm., approximately in the Peters stage.

The specimen demonstrates with particular clarity the following features which have been observed with more or less assurance in other embryos of the same general age group: the disproportion between the degree of development of the basal and the superficial trophoblast; the occurrence of widely dilated maternal blood sinuses forming a partial wall about the narrow border zone; the emigration of syncytial wandering cells into the maternal stroma and the frequent association of necrosis hemorrhage and edema with their presence.

Taken in conjunction with other presomite human embryos, the Yale specimen is of value in attempting to establish an index to the amount of vascular and cellular reaction normally associated with the early stages of implantation.

(84) *86. So-called endocytogenetic origin of chief cells (chromophobes) from chromophils in the anterior lobe and the origin of the basophilic cells that invade the posterior lobe of human hypophysis.* A. T. Rasmussen, Department of Anatomy, University of Minnesota.

Small chromophobes or chief cells apparently wholly within large chromophils, especially in basophils, are frequently seen in thin sections of the anterior lobe of the human hypophysis. This appearance has been interpreted as evidence that in the later phases of cytomorphosis of the chromophils, small chromophobes arise from them intracellularly (Collin, '28). Small acidophils are also frequently found apparently within basophils and even a basophil within an acidophil. However, in every case where a complete series of a cell with such inclusion could be followed, the apparently inclosed cells project beyond the cytoplasm of the enclosing cell; so that a more probable explanation is that the larger cell has more or less surrounded small adjacent cells. In certain planes of section one might be led to the erroneous conclusion that one cell was wholly within another one. Sections will be exhibited to illustrate these points. Endocytogenetic origin of chromophobes is considered a misinterpretation of the morphology.

Since the basophilic cells found in the posterior lobe to a greater or lesser extent in most human hypophyses have attracted considerable clinical attention in recent years, interest in their origin has increased. Additional evidence will be presented favoring their origin from pars intermedia. That these basophilic cells react like the basophils of the anterior lobe in so-called pituitary basophilism (as will be demonstrated) is not considered proof that they have migrated from the anterior lobe; but merely indicate that the cells of pars intermedia may differentiate into cells that both morphologically and functionally are like the basophils of the anterior lobe. (See demonstration no. D43.)

(115) *87. Factors controlling the diurnal spermatogenic cycle of the male sparrow* (*Passer domesticus*). Gardner M. Riley, State University of Iowa. (Introduced by E. Witschi.)

In the normal development of the sparrow testis, a daily period of active spermatogenesis is found between the hours of 2.00 A.M. and 4.00 A.M. This restriction to the hours of darkness appears all the more significant since an inversion of the light period results in the occurrence of mitotic figures during the afternoon hours.

A marked lowering of the body temperature of the sparrow during the night suggests a relationship between temperature and spermatogenesis. An average difference of more than 6° exists between the temperature of the bird during the light period (109.8°F.) and the dark period (103.1°F.). When the body temperature is lowered during the light period by clipping the feathers and exposing the bird to a low external temperature, some mitotic figures are found within 2 hours. On the other hand, if the bird is kept active during the night so that it maintains a temperature approximating that of the day, spermatogenesis is almost completely checked.

Testicular development during the inactive period was induced through injections of pregnant mare serum. A determination of the interval elapsing between the time of injection and the appearance of mitotic figures showed spermatogenesis occurring within 5 hours of the injection, whether it was made during the light or dark period. These observations indicate that the diurnal spermatogenic cycle is controlled by a sequence of environmental and internal factors. The dark period causes reduction of the body temperature which, in turn, appears necessary for the release of the gonadotropic hormone.

(21) *88. Changes in electrical potential during normal and experimentally induced oestrus in rats.* P. V. Rogers, Department of Anatomy, Yale University School of Medicine. (Introduced by Edgar Allen.)

Electrical potentials, as read on the Burr-Lane microvoltmeter, show not only the times of ovulation in rabbits, but also consistent changes during normal oestrous cycles of rats. Similar changes have been induced by injections of theelin in ovariectomized animals. Animals are anesthetized with sodium amytal during observations. One lead is taken from the symphysis pubis while the other is placed inside the vagina.

In a series of twenty-five normal rats curves closely correlated with the oestrous smear records were obtained. At the time of cornification the vagina is negative to the symphysis by several thousand microvolts. As soon as leucocytes begin to appear there is a sudden reduction in the potential. It is then gradually built up until it reaches a peak again at the next oestrus.

Removal of the ovaries causes the cyclic type of curve to disappear. In its place there occurs a day to day patternless rise and fall.

Administration of theelin to a castrate animal causes a marked rise in the potential about 19 hours after the first injection. This is followed by a drop succeeded by a higher peak as the animal comes into oestrus on the morning of the third day.

These experiments are being continued and extended to include electrical changes during pregnancy, pseudopregnancy, and after hypophysectomy, and administration of anterior pituitary extracts.

(63) *89. A study of gut epithelia in chorioallantoic grafts.* Dorothea Rudnick, Department of Zoölogy, University of Rochester. (Introduced by B. H. Willier.)

Differentiation of gut epithelium of the chick embryo has been studied in chorioallantoic grafts where the total age of the tissues approximates 10 days' incubation. During this period, in normal development, the entoderm undergoes at different levels a primary differentiation into a number of distinctive epithelial types.

Grafts of small (1/18) pieces of the head-process blastoderm (Rawles, '36) show two strikingly distinct areas with regard to gut differentiation. The anterior region, as far back as 0.3 mm. posterior to the primitive pit, may produce epithelium typical of any level; this region is almost equipotent, with a slight anteroposterior differential. The epithelia are unorganized and show only traces of orderly relation among themselves. In contrast, the region from 0.3 mm. to 0.7 mm. behind the pit is unique in capacity to produce beautifully organized intestine.

Lack of localization of gut epithelia at the head-process stage is not surprising in view of epithelial differentiation in grafts of various gut levels of 18- to 27-somite embryos. Although organ formation of stomach, small and large intestine occur in grafts from appropriate levels, epithelia from foregut (including stomach) transplants remain exceedingly plastic, and may take on forms typical of other gut levels.

The early localization of midgut corresponds to the original location of its mesodermal component. Its relative stability of differentiation as contrasted with fore- and hindgut may be correlated with simpler developmental mechanics.

(10) *90. Development of the cells of blood and bone marrow of the rabbit.* Florence R. Sabin, The Rockefeller Institute for Medical Research.

Studies of the blood cells of young rabbits show that both red and white cells are low in late fetal stages. The rabbit gets the full number of red cells per cubic millimeter characteristic of the adult animal during the second and third weeks of life. During the early part of this period the marrow cavity is small and hence the marrow becomes hyperplastic and predominantly erythroid. By the fourth week the size of the marrow cavity has increased so much that this hyperplasia is reduced. The high content of hemoglobin per red cell known to be characteristic of the fetus is reduced to the normal proportion by the third month of life.

The white blood cells increase for the most part more slowly and the numbers do not become equal to those of the adult animal until the fifth and sixth months. The monocyte is the one exception for it develops rapidly and reaches its full quota during the first week of life. The major group of the granulocytes, that is, the pseudo-eosinophiles, does not increase in the blood stream during the first month but after that increases gradually at the same rate as the lymphocytes; the lymphocytes increase rapidly for the first month and then more slowly for the next 4 months.

(85) *91. Cytological evidences of cyclic changes in the anterior pituitary of doves and pigeons.* J. P. Schooley and Oscar Riddle, Carnegie Institution, Cold Spring Harbor. (Introduced by G. B. Wislocki.)

An attempt is made to analyze the functional state of the secretory cells by their cytological manifestations in birds with well-marked and continuously recorded reproductive cycles. Some pituitary transplants have been used to test histological findings. Technical methods which reveal Golgi mitochondria as well as secretory granules were used. Representative stages have been recorded in single exposure, unretouched color photomicrographs.

Basophils are in a state of active excretion (degranulation) while ova are in the phase of extremely rapid growth. They become atrophic about the time of ovulation and remain so during incubation and earlier days of feeding young. Acidophils assume excretory activity near the time of ovulation, increasing in excretory and secretory activity during incubation and early feeding young; their activity level is low from near end of feeding young until next period of incubation. Pituitaries of incubating males exhibit similar changes.

These studies indicate that cells in excretory activity tend toward degranulation. Cessation of excretory function is accompanied by accumulation of secretory granules. During secretory activity Golgi mitochondria are finely divided, dispersed or not visible; cessation of this activity is associated with pronounced condensation of Golgi mitochondria. Extreme and prolonged secretory activity may surpass excretory activity and therefore result in some accumulation of secretory granules and in condensation of Golgi mitochondria. Changes in functional state seem more influential than changes in cell number.

(145) *92. The effect of experimental lesions of the cortex upon the 'psychogalvanic reflex.'* Henry G. Schwartz, Department of Anatomy, Harvard Medical School. (Introduced by George B. Wislocki.)

Using changes in the resistance of the skin to the passage of a constant electrical current as a quantitative indicator of sympathetic activity, an attempt has been made to determine the localization of the 'psychogalvanic reflex' in the cerebral cortex of cats. Unilateral lesions were made under aspetic technique through large bony defects. Animals were examined repeatedly during the post-operative interval ranging from 3 to 6 months. Serial sections of the brains were made. It has been found that the 'psychogalvanic' response is present on both sides, when the sensorimotor area is removed on one side and the premotor area is preserved. Secondly, the response persists when the entire cortex with the exception of the premotor or prefrontal area has been removed on one side. Finally, the response is abolished on the contralateral side when the premotor or prefrontal areas alone are removed. From the results it is concluded that the integrity of the premotor or prefrontal area is necessary for the production of a 'psychogalvanic reflex' in the cat, and that the mechanism is a crossed one.

(3) *93. The separation of and spectrographic analysis of pure samples of cell components.* Gordon H. Scott, Department of Anatomy, Washington University School of Medicine, St. Louis.

Ultracentrifuging of pulped livers and testes of guinea pigs permits the separation of the cell components. When the rotor of the centrifuge, with its contents, is frozen in liquid air and the whole placed in a specially designed cryostat and dehydrated in vacuo at —32.5°C., parts of the cells which have separated remain in position and can be identified in stained sections of samples.

Identification having been established it is simple to analyze spectrographically the dried centrifuged tissue pulp. Four fractions are recognized: nuclear material, a mixed nuclear and cytoplasmic and whole cell portion, pure cytoplasm and its inclusions, and a clear, characterless cell sap. Emission spectrograms of these cell components will be presented and discussed.

(55) *94. The appearance of myelinated nerve fibers as observed with polarized light.* H. E. Setterfield, Department of Anatomy, Ohio State University. (Introduced by R. A. Knouff.)

This paper is a description of the cytological features of myelinated nerve fibers that can be observed by means of the polarized light technique. The aim was to attempt to verify in freshly killed, unstained fibers, the presence of the various structures usually described in such fibers by the usual staining methods. In a separate demonstration photographs are presented illustrating the structures described. The appearance of normal and degenerating fibers is compared. A new interpretation of the relationship of the non-neurofibrillar portion of the axis cylinder to the incisures of Schmidt-Lantermann is given. The following structures have been demonstrated in this study: true axis cylinder, myelin, non-neurofibrillar portion of axis cylinder, neurokeratin, sheath of Schwann, cementing disc, bracelets of Nageotte, incisures of Schmidt-Lantermann, infundibulum (with a modification of this structure from the usual description), apparatus of Golgi-Rezzonico, infundibular rings, fissural rings, axonal rings, and possibly neurofibrils. The following structures could not be identified: sheath of Mauthner, extra-fissural rings, spherules of Erlholz, and 'dust' particles. (See demonstration no. D51.)

(64) *95. On the development of the male urethra and associated glands in the spermophile (Citellus tridecemlineatus).* A. H. Siddiqi, Lucknow University, India. From the Department of Anatomy, University of Toronto. (Introduced by W. H. Piersol.)

Serial sections of spermophile embryos of 11, 13, 17, 19 and 35 mm. C.R. length were prepared and studied for the development of the penile urethra, bulbo-urethral glands, bulbar glands and the penile duct.

Conclusions: 1) Bulbar glands, bulbo-urethral glands, and the penile duct are purely ectodermal in origin. 2) The penile portion of the urethra up to the orifice of the penile duct is endodermal and the terminal portion beyond this point is ectodermal in origin. 3) An attempt is made to draw up an homology between these structures of the spermophile and those of man.

(129) *96. The behavior of lymph vessels in omental adhesions.* Parke H. Simer and Richard L. Webb, Department of Anatomy, College of Medicine, University of Illinois.

Laparotomies were performed on dogs under nembutal anesthesia. The mesenteric blood and lymph vessels of a small portion of jejunum were ligated 4 cm. from the gut. The serosa of this segment of intestine was irritated and the distal portion of the omental sac sutured to it. In some animals, the omentum was also sutured to the mesentery.

Post-mortem examinations followed the operations at intervals of 6 to 16 days. Subserosal injections of India ink were made in the jejunum near the omental adhesions. In every animal in which an omental-mesenteric suture was made, collateral lymphatic drainage had been established, as verified by macroscopic examination and subsequent histologic study. In those adhesions which involved only the omentum and jejunum, the results were less uniform. In no case was it possible to demonstrate collateral lymphatic drainage in the adhesion between the omentum and the peritoneal surface of the midline incision.

(36) *97. Functional changes of the living malpighian body viewed from the morphological aspect.* Edward Singer, Research Department, St. Clare's Hospital and Tumor Institute, New York.

This study is based on observation with the fluorescence microscope using lenses with high numerical aperture. Morphological changes can be observed by using substances with fluorescence properties. The majority of the various substances show fluorescence color only in definite parts of the malpighian body if irradiated by ultra-violet rays making possible a selective staining.

The fluorescence properties of the substances, such as color, brightness, and hue is influenced by the functional state of the malpighian body. Interpretation of function can be made after examining the substances, according to their ability to show fluorescence in neutral, in acid and in alkaline solutions as to their chemical properties and as to their behavior in the electrical field of the blood plasm.

(12) *98. Age difference in onset of gonad endocrine activity in male and female rats.* George K. Smelser and Helen M. Clark, Department of Anatomy, Columbia University. (Introduced by P. E. Smith.)

Castration of male rats at birth inhibits development of the accessory reproductive organs, their weight being less than half that of littermate controls when autopsied at 18 to 19 days of age. The castration effect is clearly marked by the fifth day, affecting the penis and bulbo-urethral glands as well as the seminal vesicles and prostates.

Spaying at birth does not inhibit development of the uterine mucosa during the first 18 or 19 days of life, though it may affect the muscularis as is revealed by planimeter measurements of these layers in several sections of each uterus.

Spaying at 16 to 19 days of age markedly inhibits development of the infantile uterus. The experimental uteri at 31 days average about half the weight of normal littermate controls. First oestrus normally occurs at from 40 to 45 days in these rats.

The uterus will respond to theelin at any time after birth. Forty R.U. of theelin during the first 4 days of life produced an average uterine weight increase of 171 per cent. There is strong indication that the uterus responds more from 1 to 10 days than from 11 to 20 days of age. Uterine epithelium and muscularis are increased two to three fold whereas the mucosa stroma is but slightly affected.

Testicular hormone is produced at birth whereas theelin secretion begins later.

(20) *99. Menstruation and the uterine response to oestrin and progestin in hypophysectomized monkeys.* Philip E. Smith, H. H. Tyndale and Earl T. Engle, Department of Anatomy, College of Physicians and Surgeons, Columbia University.

Observations are reported on seventeen adult or subadult rhesus monkeys in which the anterior and posterior hypophysis was removed by an oral approach. Fourteen of these were autopsied and the completeness of the ablation verified. Post-operative periods vary from 4 to 111 days. Eighteen 10-day periods of injections with dihydrotheelin, Progynon B or Amniotin were given. Following this progestin (½ Rab.U./day) for 10 days have been injected in four cases.

Animals hypophysectomized in the mid-interval and showing a well-developed sex coloration bled in 1 to 4 days. Immediate estrin injections prevented bleeding. The one castrated animal which was hypophysectomized did not bleed. If untreated the endometrium shows an involution which is as profound or greater than after castration. The involuted endometrium develops into a typical proliferative type with 10 days of estrin (400 to 500 R.U./day were used). Following cessation of treatment grossly evident bleeding may not occur and is always delayed (10 to 21 days). Progestin treatment for 10 days after estrin induces a pregravid endometrium. In the three animals given 2 Rab.U./day bleeding occurred in 3 to 4 days after cessation of treatment. One animal given 1 Rab.U./day did not bleed although it had a pregravid type of endometrium. The progestin treated animals are still living and the completeness of the ablation has thus not been verified though they are believed to be complete.

(26) *100. Ocular responses elicited by electrical stimulation of the cerebral cortex.* Wilbur K. Smith, Department of Anatomy, University of Rochester, School of Medicine and Dentistry.

Electrical stimulation of cortical areas in the frontal lobe of the rhesus monkey (Macaca mulatta) was found to produce both somatic and autonomic ocular responses.

A marked lateral nystagmus of both eyes toward the contralateral side was obtained from an area near the caudal end of the sulcus principalis (sulcus rectus) just rostral to the inferior precentral sulcus.

Excitation of an area situated more medially resulted in a sustained conjugate deviation of both eyes toward the contralateral side.

Closure of the eye, most marked contralaterally, occurred when the stimulus was applied just caudal to the area from which nystagmus was obtained.

Stimulation of an area medial to the inferior precentral sulcus produced a group of movements which together simulate an awakening response; both eyes, while opening, slowly deviate toward the contralateral side, the pupils dilate and the eyes close and open several times.

The responses were recorded cinematographically. (See demonstration no. D52.)

(153) *101. Further observations on the experimental production of superfetation.* Franklin F. Snyder, Johns Hopkins University.

In pregnant rabbits in which embryos occupied only one horn of the uterus, an attempt was made to obtain implantation of a second set of fertilized ova in the unoccupied horn. A second set of corpora lutea was provided at 25 days by a single injection of extract of urine of pregnancy. At the time of injection of the pregnant animal, a non-pregnant doe was mated in order to obtain embryos for transfer to the unoccupied horn of the pregnant animal. After an interval of 5 days the blastocysts were washed from the uterus of the second doe and transferred by pipette into the empty uterine horn of the pregnant animal under aseptic conditions. As a control, several blastocysts were also transferred to a non-pregnant doe in which ovulation had been induced 5 days earlier by injection of urine extract. It was found that implantation occurred in the non-pregnant doe, while in pregnant animals, implantation failed to occur. In view of the fresh crop of corpora lutea in the ovaries and the presence of normal blastocysts in the uterus there was evidence that failure of implantation was related to functional alteration of the uterine mucosa.

(49) *102. The nuclei of the thalamus of Sus scropha.* Othmar Solnitzky, Department of Anatomy, Georgetown University. (Introduced by O. B. Hunter.)

This study is based on a series of transverse serial sections, 40 μ thick, stained alternately with thionin and Morgan's hematoxylin.

The anterior nuclear group consists of three well-defined nuclei: a long, narrow, deeply-staining, anterodorsal nucleus, a medium-sized anteromedial nucleus, and a large anteroventral nucleus.

The midline group of nuclei is well differentiated and includes the nucleus interparataenialis, nucleus interanteromedialis, nucleus centralis medialis, nucleus reuniens, and nuclei paraventricularis anterior and posterior.

The medial group consists of the nucleus parataenialis, nuclei medialis dorsalis and ventralis, nucleus centralis lateralis, nucleus paracentralis, nucleus parafascicularis, and the centre median nucleus. The latter nucleus is well delimited, although not very large.

The ventral group of nuclei is the largest of the thalamic nuclear groups and consists of conspicuously lobulated masses. The largest of these nuclei are the nucleus ventralis, pars externa and the nucleus ventralis, pars arcuata.

The lateral group of nuclei is not so conspicuously large and well delimited as the ventral nuclear group, with the exception of the nucleus reticularis. The pulvinar is inconspicuous. The lateral geniculate body is massive and subdivided into a larger dorsal and a smaller ventral portion. The medial geniculate body is relatively large and well defined.

(106) *103. Studies on the comb of the capon (Gallus domesticus) before and after the direct application of comb-stimulating substance extracted from the urine of the human.* D. Soloway, L. P. Hansen and J. F. McCahey, Jefferson Medical College. (Introduced by J. Parsons Schaeffer.)

Comb-stimulating substance extracted from the urine of normal and abnormal males was assayed quantitatively by intramuscular injection of 4 cc. of the

extract in oil into White Leghorn capons. There was a proportional growth of the comb to the amount of hormone present in a definite quantity of urine. It was found that a direct application of only ½ cc. (representing extract of 250 cc. of urine) to the comb produced marked growth always greater and much more rapid than with parenteral use.

Daily measurements in millimeters were made of the total length of the comb and of four of its serrations beginning several days before the application and until the bird was sacrificed. Combs were obtained from the first to the eighth day following the first application. Small pieces of the comb were fixed in various agents including formalin and osmic acid. The extract being dissolved in sesame oil, the presence and distribution of the oil should be detectable, especially in view of the marked unsaturation of the oil. Histological studies to determine the correlation between penetration and distribution of the oil and the factors inducing the morphological changes were undertaken.

Painting the combs with various other products such as sesame oil alone, gonadotropic hormone produced no change.

(47) *104. The formation and metamorphosis of the 'retraction cap of injury' of striated muscle fibers in living frog tadpoles.* Carl Caskey Speidel, Department of Anatomy, University of Virginia Medical School.

By means of electrical stimulation a fiber of striated muscle may be induced to contract so strongly that a slight injury results. The most vulnerable place in a fiber is at the end; i.e., at the muscle-tendon junction. In a slightly injured fiber the end pulls back somewhat and swells. A 'retraction cap of injury' is formed almost immediately. This is a hard, tough, resistant compound which serves to prevent further retraction. Between the retraction cap and the main body of the fiber is a transition zone of irritation in which the cross striae disappear. In the middle portion of the fiber irritative phenomena are also noticeable: the Z discs become conspicuous, myofibrils stand out clearly, and the Q discs appear more granular.

During recovery the following changes ensue: the retraction cap becomes dissolved (sometimes within a few hours), muscle protoplasm and nuclei, with or without mitosis, move to occupy the end zone, the swollen end of the fiber is subjected to longitudinal tension, and new cross striae are formed. Often at first the regenerating end of a fiber develops several pointed conical sprouts, each with its own developing cross striae. These later become aligned to form continuous cross striae extending across the entire fiber. Two or 3 days may be sufficient for complete recovery.

Retraction caps may be induced in many other ways. (See demonstration no. D54.)

(161) *105. Defective endocrine glands associated with structural disharmonies and lethal reactions.* Charles R. Stockard, Cornell University.

Through the hybridization of pure dog breeds, the differences in growth reactions of various tissues and body regions in giant and dwarf animals and in breeds exhibiting localized growth anomalies have been studied during the past few years. Striking structural disharmonies have arisen as a result of

failure in the regulation of growth coordination which is usually so pronounced in the normal individual. Disharmonies in size and form between the upper and lower jaw, skin and body size, and among various skeletal parts are to be discussed. Gross deformities and modification in the axial and appendicular skeletons as well as in other tissues have occurred.

Peculiarly localized lethal effects are found in the central nervous system of certain breeds. The nature of the paralysis resulting from this hereditary lethal is considered on the basis of its genetics and general development.

All of the breeds and hybrids exhibiting these structural disharmonies, as well as those showing the peculiar lethal character, possess decidedly defective endocrine systems. Evidence will be presented which indicates that the pituitary gland is particularly defective, and its relation either as a causative or associated factor in these reactions will be considered.

(61) *106. Experimental studies of various developmental stages in the lateral-line system of amphibians.* L. S. Stone, Department of Anatomy, Yale University School of Medicine.

Experimental investigations show that the lateral-line system in amphibians passes through five important stages of development, viz., induction by the early medullary plate, the establishment of polarity in its placodes, the initiation of migration of its primordia, the formation of primary organs, and the establishment of accessory organs by budding from the primary organs. Polarity of a primordium is not irreversible before migration is initiated, for it can be experimentally changed by the influence of an older, already migrating, primordium contacting the graft. Before migration, however, there are already predetermined certain growth limits, the type and number of organs and their group arrangement. These facts are demonstrated by exchanging the lateral-line primordia between embryos of different species and of embryos of different developmental ages.

Initiation of migration marks an important independent stage in the development of a lateral-line primordium and is associated with the formation of primary organs which, furthermore, may be laid down independent of a nerve supply. It is an interesting fact, however, that mature primary organs still possess cells which simulate the early primordia, for at various poles of an organ peripheral cells proliferate and by budding produce accessory organs. A long chain of many new organs can be experimentally induced from a single primary or accessory organ by means of appropriate wound areas or by tail grafts in larvae.

(162) *107. The significance of the germ-layer theory in the light of early primate embryos.* George L. Streeter, Carnegie Embryological Laboratory, Baltimore.

There are now available, as representatives of the macaque embryo, a sufficient number of closely seriated stages which have been prepared with adequate techniques, to make it possible to trace morphologically the early organization of the developing ovum and the segregation of the embryo itself from those parts that are to serve merely as auxiliary structures and are to be discarded at birth. Freed from the dangers of hypothetical stages the investigator can now,

to a considerable extent, test in actual specimens the theories of tissue differentiation and organogenesis. Availing himself of such material the author has arrived at the conclusion that the three-germ-layer theory is concerned with a relatively late phenomenon and that it should be restricted to the embryo proper. It cannot be satisfactorily extended to the auxiliary parts of the ovum which are modified in many ways in adaptation to the specialization of the reproductive tracts of the animals concerned. The segregation of the auxiliary parts from those cells which are to form the embryo is a phenomenon definitely antecedent to the grouping of the body tissues into three principal layers and it must therefore be regarded as a more primitive process and thus more fundamental.

(157) *108. Endometrial response on implantation of the ovum in the Macaque monkey.* George L. Streeter and George B. Wislocki, Carnegie Embryological Laboratory, Baltimore.

The egg is free until the ninth day. At that time the trophoblast cells of the blastocyst at the embryonic pole undergo active proliferation and the more superficial ones take on the character of syncytium and make the first attachments. Up to then the endometrium shows little change. Beginning with the tenth day the endometrial epithelium proliferates and makes a sharply localized placque which the ovum erodes so as to abut on the underlying stroma. On the eleventh day a similar and equally large placque appears on the opposite wall constituting the secondary implantation site. This is before there is any attachment of the ab-embryonic pole of the blastocyst. The placque stage persists until the chorionic villi are formed (seventeenth day) and then the margin separating the embryonic structures from the maternal takes the form of an advancing zone of degenerating tissue which is interpreted as corresponding to the fibrinoid stripe seen in human material. This peripheral degenerating crust maintains a rather uniform thickness in the subsequent stages and can be recognized in the fully formed placenta. Thus we can speak of a placque or previllous stage of implantation as distinct from the fully developed type which succeeds it.

(80) *109. Observations on the posterior median aperture of the fourth ventricle.* R. M. Strong, Ethel A. Chapman and Albert Dado, Department of Anatomy, Loyola University School of Medicine, Chicago.

Serial sections of human and monkey brains have been made, great care being taken to avoid the strains ordinarily involved in removing a brain before fixation. Injections and reconstruction methods have been utilized. Our observations indicate that the posterior median as well as the lateral apertures are not artefacts. They are, however, variable in shape and size. (See demonstration no. D56).

(66) *110. Axis determination in the hind limb of Amblystoma punctatum.* Walter Alva Stultz, University of Georgia School of Medicine, Augusta. (Introduced by G. Lombard Kelly.)

The following experiments were carried out in order to test the time of determination of the dorsoventral axis of the hind limb of Amblystoma punctatum.

The limb rudiment in each case was taken from the left side of the body and implanted on the right side upside down so that only the dorsoventral axis was reversed in grafting.

The host and donor in each case were of the same stage. All stages were tested between 37 and 44 (Harrison).

Reduplications occurred in over two-thirds of the resulting cases.

In stages 37 and 38 all primary limbs developed with normal orientation. In stage 39 the majority of the primary limbs were normally placed while a minor number developed in inverted position. In stage 40 approximately half of the resulting primary limbs were normal and half inverted. From stage 41 on all primary limbs were inverted. It may therefore be concluded that determination of the dorsoventral axis takes place by stage 41.

(39) *111. Effect of adrenalin and pilocarpin upon thyroid-stimulating power of thyreoactivator in guinea pigs.* Harry A. Teitelbaum and Eduard Uhlenhuth, Department of Anatomy, University of Maryland.

It has been reported in amphibia (Uhlenhuth and Van Slyke) that addition of adrenalin or pilocarpin to thyreoactivator (TA) accentuates the response of the thyroid to the latter as indicated by colloid content, number of colloid vacuoles, and cell height.

In one experiment, one group of guinea pigs served as uninjected controls, a second group was injected with TA (equivalent to 25 mg. dried prehypophysis), a third was injected with adrenalin, a fourth with TA and adrenalin. In another experiment, one group served as uninjected controls, a second group was injected with TA, a third with pilocarpin, a fourth with TA and pilocarpin.

One or two animals of each of the eight groups were sacrificed after each of eleven injections. The thyroids were fixed and sectioned; the cell height was measured by means of an ocular micrometer. The thyroids of animals receiving TA alone in both experiments had higher cells than the thyroids of control animals. Neither adrenalin nor pilocarpin alone had any effect on the cell height. Adrenalin added to TA, however, accentuated the power of the latter to increase the cell height. Pilocarpin added to TA inhibited the TA effect on the thyroid cells for the first five injections; but from the fifth to the ninth injection it markedly accentuated the power of TA in increasing the cell height.

(41) *112. Effect of prolonged thyreoactivator injections upon metabolism of adult salamanders.* James U. Thompson and Eduard Uhlenhuth, Department of Anatomy, University of Maryland.

Oxygen consumption of adult California newts was measured by a method suggested by Prof. O. G. Harne of the Department of Physiology of the University of Maryland Medical School. Animals previously starved for several weeks and tested at a temperature of 22°C. show a constant value of O_2 consumption (0.23 cc. per 1 gm. body weight and per 30 minutes).

Single feedings of earthworms or liver increase oxygen consumption about 50 per cent. Injections of muscle extract (prepared in the same manner as prehypophysis extract) increase O_2 consumption for a short period, after first few injections, from 10 to 40 per cent, but it soon falls and fluctuates about the normal basal level.

Injections of thyreoactivator (TA) equivalent to 50 mg. dried prehypophysis per dose cause a rise of oxygen consumption of from 150 to 200 per cent. Continued TA injections (up to seventeen injections) maintain O_2 consumption, with fluctuations, from 50 to 150 per cent above basal level throughout the experiment.

TA injections increase O_2 consumption in the adult salamander in the same way as in the larval salamander (as found by Uhlenhuth and Schwartzbach in 1929) and as in mammals. Contrary to observations in mammals no diminution in effectiveness of our extract in raising O_2 consumption could be noted after seventeen injections.

(73) *113. Skeletal maturation in man and Mammalia.* T. Wingate Todd, Western Reserve University and Brush Foundation.

This study covers 16 years and comprises roentgenographic and anatomical observation of 600 fetuses, 400 children, 1000 mammals, 200 anthropoids and serial roentgenographic assessment of 4000 living well children from the economically stable class. Detailed results will follow.

Maturation covers ossification, bony penetration and final fusion of epiphyses. There is one mammalian pattern of maturation sequence with minor ordinal and generic modifications having a time relationship which is characteristic for each genus. Constitutional disturbance usually of nutritional or endocrine origin modifies time relationship but not sequence. Bodies of captive animals, of dead children and the roentgenograms of children who are hospitalized, or belong to the economically undercircumstanced class are unreliable for the establishment of time relationships at all stages of the sequence but particularly at the stage of epiphysial ossification.

A full clinical and nutritional long-term study of growing animals and children is essential for constructing a time relationship schedule.

With 125,000 roentgenograms and an experimental animal farm a definite and reliable time schedule has been established for the growing child permitting assessment of family patterns, of interruption, retardation, inhibition and in rare instances acceleration of the maturation pattern. This opens a new field of study in nutritional sufficiency, endocrine balance and freedom from disease which undermines the constitution. A determination of maturity status throws light on the extent if not the nature of past disturbances.

(147) *114. Pyramidal and extrapyramidal functions of the frontal lobes.* Sarah S. Tower, Department of Anatomy, Johns Hopkins University.

The fibers descending from the cerebral cortex to the spinal cord may be interrupted in their course without injuring other descending systems, at one level only, in the medullary pyramids. Above this, these fibers are associated with other descending cortical systems. Below, the descending systems from cortical and subcortical levels intermingle. By severing the medullary pyramids, pyramidal and extrapyramidal activities of the cortex may be dissociated. The former may then be analyzed in the deficiencies resulting from the lesion; the latter studied both in the activity of the still surviving animal, and, more directly, by electrical stimulation of the cortex. Experiments of this design have been

carried through on cats and monkeys. The symptomatology of the lesion will first be briefly described. Some of the activities remaining in the cortex will then be surveyed. Finally, the results of these studies will be applied to considering the relationship between pyramidal and extrapyramidal action in the motor projection from the cerebral cortex.

(40) *115. Effect of prolonged thyreoactivator injections on colloid release of the salamander thyroid.* Eduard Uhlenhuth, James U. Thompson and Joseph Schenthal, Department of Anatomy, University of Maryland.

In one series of adult Californian newts thyreoactivator (TA) injections (equivalent to 100 mg. dried prehypophysis) were stopped after two injections, the animals were killed at varying intervals after the last injection and the colloid content of the thyroid, expressed in percentages of total weight, was calculated. It continued decreasing for 4 days and then commenced to return to normal. In animals killed at varying intervals after the fourth injection, it started to return to normal on the second day after the last injection.

If, however, TA injections (of an equivalent of 50 mg. of dried prehypophysis) were continued over a period of 22 days, it was found that the colloid content, after decreasing to a minimum, remained, with fluctuations, at this low level, throughout the experiment.

The colloid which is diminished in amount by injections of TA soon begins to accumulate again, if the injections are stopped. If, however, the injections were continued, the colloid content could be kept permanently at a low level. No diminution of the effectiveness of the thyreoactivator in keeping the colloid content at a low level became apparent for as many as twenty-two injections.

(15) *116. Differences in the effect of oestrin on the urogenital tract of young and mature monkeys.* G. van Wagenen, Department of Obstetrics and Gynecology, Yale University School of Medicine.

During the last year several papers (Courrier and Gros; Parkes and Zuckerman; van Wagenen) have described, in response to oestrin, striking fibromuscular increase in the seminal vesicles and prostate with hyperplasia and keratinization of the utricle, seminal colliculus and anterior urethra. In all these experiments young monkeys were used. In the adult the tissue changes are even greater and present a different picture, particularly in the seminal vesicles, because of the elaborated epithelial arrangement in the accessory glands of matured animals.

Five rhesus monkeys (Macaca mulatta), ranging between 5735 gm. and 7220 gm. received 6000, 10,000, 25,000 and 50,000 International Units of theelin-in-oil. The duration of injections were 12, 12, 20 and 25 days, respectively. Before injections samples of tissue were taken from the seminal vesicles and caudal lobe of the prostate. Although a midline abdominal incision was used, these operative procedures were extra-peritoneal. A testis sample indicated maturity of gonad; a smear from epididymis the motility of the gamete.

One unit of theelin per gram causes complete keratinization of the sensitive parts of the immature urethra. However, in the adult metaplasia of the utricle was accomplished only in the 6040 gm. animal which received 50,000 units. The anterior urethra and seminal colliculus responded in the 6555 gm. animal which received 6000 I.U. and in all those receiving greater amounts of hormone.

(38) *117. Variations in abundance of the parafollicular thyroid cells of the dog.* E. M. Vicari, Department of Anatomy, Cornell University Medical College, New York.

An extensive study of the parafollicular cells in the thyroid of the dog shows a wide variability in the amount of these cells. The material studied consists of over 300 dogs, representing eighteen pure breed types and known hybrids from various combinations of these pure breeds. The ages studied were: birth, 1 week, 3 months, 6 months, 9 months, 1 year, and adults ranging from 2 years to 12 years. The study shows that the age 'per se' does not materially influence the amount of parafollicular cells; also that what is true for one breed is not true for another at a given age. The amount of parafollicular cells in the adult is not necessarily proportional to the amount found in the young stages of the same breed. Certain breeds normally exhibit greater amounts of these cells than other breeds. Variations in the normal amount of these cells for the breed are produced by physiological and pathological changes in the individual. Parafollicular cells are still found in the walls of the follicles in adults over a year old. There appears to be a direct relationship between the activity of the thyroid and the amount of parafollicular cells.

(30) *118. Thalamo-cortical connections in the cat. Preliminary report.* W. H. Waller and R. W. Barris, Department of Anatomy, George Washington University Medical School.

To locate the cortical regions which receive fibers from the nuclear masses in the dorsal thalamus, part of the occipital, parietal, or temporal cortex was surgically removed in each of eleven cats, 2 to 8 weeks were allowed for degeneration, and the thalami were sectioned and stained with cresyl violet. In the following statement of results, we have used the terminology of Ingram, Hannett and Ranson ('32) for the thalamic nuclei.

In ten experiments in which the marginal gyrus was injured, cell reactions were observed in various parts of the dorsal nucleus of the lateral geniculate body, indicating that the marginal gyrus receives most of the visual fibers.

In three cats injury to the posterior sylvian and posterior ectosylvian gyri caused degeneration in the medial geniculate body.

Cell reactions in the lateral and posterior thalamic nuclei and the pulvinar occurred in eight cases of lesions of the middle suprasylvian gyrus.

The ventral external and arcuate nuclei were affected in two instances in which the lesions involved the posterior sigmoid gyrus.

The anteroventral and anterodorsal nuclei degenerated following one large lesion extending into the splenial and suprasplenial gyri.

Several large lesions, with long degeneration time, have apparently given rise to some cell changes in the pretectal nucleus.

Further experiments are in progress, using smaller lesions to delimit precisely the boundaries of all cortical areas receiving fibers from the thalamic nuclei.

(77) *119. Peculiarities of the vascular system of the finback whale (Balaenoptera physalus).* Robert Walmsley, Department of Embryology, Carnegie Institution of Washington, and Department of Anatomy, Edinburgh University. (Introduced by G. L. Streeter.)

Dissections of the vascular system of the finback whale have been made on two foetuses—46 cm. and 147 cm. long, respectively; certain observations also have been made on the brains, spinal cords and meninges of two adult finbacks.

In addition to the observation of the frequently described retia mirabilia, another commonly occurring feature of morphological interest was noted. This is the substitution of multiple arterial stems for the single arteries present in most mammals.

The arterial supply of the genital organs and the urinary bladder is by a series of bilateral parallel vessels that arise from the posterior part of the aorta. The uterine arteries divide into many fine twigs, that along with their venae comites, convert the broad ligament into an extremely vascular fold. Further examples of multiple vessels replacing the more common single stems are illustrated by the blood supply to the heart, the mandible and the brain.

(35) *120. The mid-brain and cerebellum of the American rattlesnake and the American copperhead snake.* Francis J. Warner, Neuropathological Laboratory, Topeka State Hospital, and Department of Anatomy, University of Kansas Medical School. (Introduced by H. C. Tracy.)

The mid-brain of these serpents resembles greatly that of Lacerta vivipara and Chameleon vulgaris. The optic tectum is practically identical with that of other reptiles. The tecto-bulbar and tecto-thalamic tracts are similar to those found by DeLange in Varanus salvator.

The oculomotor and trochlear nuclei are quite similar to those found in Lacerta vivipara and Chameleon vulgaris. However, the accessory oculomotor nucleus (Edinger-Wastphal nucleus) is smaller and less well defined than in Varanus salvator. The ganglion isthmi is much smaller and poorly developed than that present in Lacerta vivipara and Chameleon vulgaris.

The cerebellum in both serpents was similar, consisting of a flat, lamellated structure. In contrast to Varanus salvator it is not of the exverted type. It has, however, all the three typical cerebellar cell layers, present in other reptiles. The granular layer faces ventrally while the layer of Purkinje cells lies above it and consists of a layer of two or three cells thickness. The molecular layer faces dorsally and covers the other two layers. The medial part of the cerebellum is greatly hypertrophied while the pars lateralis and auricular lobe is but slightly developed. There is also present a medial and a lateral basal cerebellar nucleus.

There was found a well-defined brachium conjunctivum anterius, a large spinocerebellar tract and a well-defined vestibulo cerebellar tract. A tecto-cerebellar tract is likewise present but there is no olivo-cerebellar tract to be found.

(43) *121. Intranuclear crystals in the hepatic cells of the dog.* Harold L. Weatherford, Department of Anatomy, Harvard Medical School.

Intranuclear crystals occur in certain hepatic cells of most dogs. The crystals are presented mostly as tetragonal prisms, while some hexagonal plates are found. Twinning and deformed crystals have been seen. Usually only a single crystal surrounded by a clear area appears in a nucleus, but two or more crystals may be present in the same or in separate clear areas. The cells containing intranuclear crystals generally have normal appearances, although crystals have been observed in degenerating cells. Crystal sizes vary from those no larger than a nucleolus up to prisms 35 μ long. Large crystals lead to nuclear distortion and stretching of the nuclear membrane. The percentages of nuclei containing crystals vary from 0.5 to over 2 per cent. Long suspected of being hemoglobin because of tinctorial reactions, the crystals have in recent years elicited renewed interest through the work of Berg, who thinks that they are probably allantoin. Chemical, microincineration, and crystallographic studies on normal and anaphylactic dogs, and on dogs before and after injection of hemoglobin show that the crystals are not hemoglobin, but probably some product of purine metabolism. The report will contain data from mixed and pure breeds of dogs, including the Dalmation. Dalmation dogs which excrete uric acid and lesser amounts of allantoin than other breeds are found as a class to have fewer intranuclear crystals. (See demonstration no. D61.)

(122) *122. Numerical changes of mast cells within the dermis of the white rat.* Richard L. Webb, Department of Anatomy, College of Medicine, University of Illinois.

In making mast cell counts of connective tissue, most investigators have used subcutaneous spreads. It is the belief of the writer that the possibility of serious error enters into counts made on such material. The distribution of fat in this region depends on the nutritional condition and the maturity of the animal, the tissue contains vessels of considerable size along which the mast cells accumulate in large numbers, and there is no uniformity in the thickness of these spreads. In an attempt to overcome these objections, sections of dermis were cut at a uniform thickness and a field of uniform size was counted during each observation. The ages of the rats counted ranged from the 19-day fetus to the fifty-first day individual.

It was found that a constant increase in numbers of mast cells occurs between 5 days before birth to the nineteenth day after birth, an increase of ten times. By the thirtieth day the count drops to twice that of the 19-day fetus and remains relatively fixed to the fifty-first day.

A further consideration of these data involves the correlation of the area counted with the total surface area of the animal studied.

(6) *123. Quantitative control of nerve regeneration by the periphery.* Paul Weiss and Raymond Litwiller, Department of Zoölogy, The University of Chicago.

1. In Urodeles amputation of a limb at its base is followed by regeneration of a new limb. Innervation of the regenerate is effected by nerve fibers sprouting out from the cut nerve trunks and invading the blastema. Histological

studies and fiber counts at various regenerative stages revealed that a regenerating limb admits nerve fibers only in proportion to its actual volume. At any stage of regeneration there exists a linear relation between the number of nerve fiber branches entering a given level of the limb and the total mass of tissue peripheral to that level.

2. If a comparatively small nerve is deviated to the base of a transplanted denervated limb of full size, the regenerating fiber branches invade the limb and fill it up to approximately the normal fiber content, never beyond this limit.

3. The often asserted fact that a normally innervated muscle fiber declines additional innervation (hyperneurotization) has been confirmed. This phenomenon is not due to the functional activity of the muscle, but rather, as suggested by Harrison, to a mechanism similar to the one preventing the entrance of supernumerary sperm into monosperm eggs.

In all the cases mentioned peripheral 'saturation' coefficients seem to be instrumental in limiting the number of nerve fiber branches admitted to the periphery from a proximal pool.

(105) *124. Responses of reproductive organs in an immature mammalian hermaphrodite to injections of pregnant mare serum.* L. J. Wells, Department of Zoölogy, The University of Chicago and Department of Anatomy, University of Missouri. (Introduced by Carl. R. Moore.)

Two somatically adult yet sexually immature hermaphroditic ground squirrels (Citellus tridecemlineatus) were discovered at exploratory laparotomy. One was given 25 R.U. of pregnant mare serum (G. H. Hart preparation) twice daily for 18 days preceding autopsy. The other was sacrificed as untreated control. Reproductive tracts of both were dissected, photographed in toto and sectioned serially at 10 μ.

Each animal possessd: *bilateral* scrota, ovotestes, tubuli recti, rete testes, ductuli efferentes, epididymides, ductuli deferentes, vesiculae seminales, glandulae bulbo-urethrales, imperfect ostia tubae, tubae uterinae and cornua uteri; *unpaired* urethra (male), glandula bulbi (bulbar gland), penis, corpus uterus and questionable atypical vagina. The prostate gland was absent in both animals.

Mare serum injections induced: 1) descent of the right ovotestis to its scrotum, accompanied by spermatozoa formation; 2) development of graafian follicles and corpora lutea with retained ova in both ovotestes; 3) stimulation of the endocrine function of the male components in the ovotestes, since all male accessories showed gross and histological stimulation; 4) marked gross and histological stimulation of all female accessories.

(46) *125. A study of the reactions of growing embryonic nerve fibers to the passage of direct electric current through the surrounding medium.* S. Culver Williams, Department of Anatomy, School of Medicine, University of Pennsylvania.

Nervous tissue from mapped regions of the medulla oblongata of 5-day chick embryos has been cultured in diluted chicken plasma-embryonic extract through which a continuous direct electric current of measured density was passing. The range of current density was from 0.1 to 6.6 δ (microamperes per square millimeter of cross section of conducting medium). The observations include some as late as 44 hours after current was started.

It was found that in *every* case where any change was seen in the culture, this change was degenerative and in no case was the direction of growth of fibers changed.

Nerve fibers survived more than 22 hours of current at density 0.1 δ, while none survived currents greater than 3.0 δ for as long as 8 hours. The onset of degeneration was delayed following exposure to current of high density for short periods; for example, while continuous current of density 5.0 δ caused degeneration in 8 hours, a similar current applied for but 1 hour was followed by degeneration only after 18 hours. It was found that short exposure might bring degeneration to fibers already well grown out, but without preventing subsequent new outgrowths.

(114) *126. Cycles of endocrine activity in annual breeders.* Emil Witschi, Department of Zoölogy, State University of Iowa.

Weaver finches have been used in the experimental study of the hormonal picture of annual breeders, because they indicate by characteristic reactions the eventual presence of male sex hormone (ducts of male, black pigment in bills), female sex hormone (ducts of female, yellow color in bills) and gonadotropic hormone (cock's plumage). The season of sexual inactivity is characterized by absence (or sub-threshold values) of gonadotropic and sex hormones. Castrates as a whole maintain the hypophyseal cycles. Though, with increasing age there appears a tendency to assume a cock's plumage even during the season in which normal controls regenerate henny plumages. This indicates an increase in hypophyseal activity in castrates, at least during the season of sexual inactivity.

(87) *127. Action of natural and synthetic oestrogenic agents on the anterior hypophysis.* J. M. Wolfe, Department of Anatomy, Vanderbilt University School of Medicine.

Oestrin injections induced pituitary hypertrophy in female rats, the degree of which was dependent on amounts injected and duration of experimental period. In adult rats daily injection of 200 units for 12 days resulted in complete degranulation of basophiles and moderate degranulation of eosinophiles. The chromophiles were reduced in percentage, the chromophobes increased. In injection periods up to 30 days the quantitative action of 200 units daily on the pituitaries of normal and castrated rats was approximately the same. Such animals presented pituitaries weighing up to 40 mg. Degranulation and reduction in percentage of chromophiles was extreme; the chromophobes were tremendously increased in percentage. The castrates remained in constant oestrus. The normals exhibited a short initial period of oestrus; then lapsed into dioestrus. In some, continuous oestrus reappeared after 3 weeks of injection; in others, dioestrus was longer. Dioestrus was associated with large corpora in ovaries and vaginal mucification. Immature female rats received various amounts of oestrin for various periods; the response in the anterior lobe was associated with the amounts injected and duration of injection period. Injection of a synthetic oestrogenic agent (9: 10-dihydroxy-9: 10-di-n-propyl-9: 10-dihydro-1: 2: 5: 6-dibenzanthracene, furnished by E. C. Dodds, London) in castrated and normal female rats induced changes in the pituitary identical to those induced by natural oestrins. (See demonstration no. D64.)

(53) *128. An illustration of coordinated development of neural centers in vertebrates.* Russell T. Woodburne, Department of Anatomy, University of Michigan. (Introduced by Elizabeth C. Crosby.)

The phylogenetic study of the trigeminal complex illustrates the process of cephalization and the coordination in development of centers at different levels of the nervous system. Development of projection paths for trigeminal impulses is coordinated with development of both the primary reception centers and the higher coordinating centers. The trigemino-mesencephalic tract, from the nucleus of the descending root to mid-brain centers, is primitive. Fibers are added from the chief sensory nucleus when this nucleus appears, namely, in amphibians, and the further development of the tract follows closely the differentiation of the nucleus and of the higher somatic correlation centers.

Coincident with the further differentiation of the chief sensory nucleus is the appearance of an exclusive projection of this nucleus forward by the quinto-frontal tract in birds and the dorsal secondary ascending tract in mammals.

It is significant that in birds the greatest development of the chief sensory nucleus, the appearance of a highly developed cerebellum, and the existence of robust fiber tracts interconnecting them are coincident phenomena. Interrelating these centers are two large tracts, one not found in other forms and the other represented by only a few fascicles in reptiles and mammals.

It is concluded that cephalization is accompanied by coordination in the development of higher and lower centers in the phylogenetic development of the brain.

DEMONSTRATIONS

D1. Testicular changes in normal and partially castrated newts given phyone injections or left untreated. A. Elizabeth Adams, Barbara Granger, Frances Scudder and Elizabeth Wilson Field, Department of Zoölogy, Mount Holyoke College.

Three groups of male Triturus 1) normals, 2) unilateral castrates, and 3) ones with left testis and mature part of right removed were given injections of undiluted phyone (dose, 0.1 cc.) every other day for 8 weeks (October to December) or were left untreated. Weights of testes (total, immature region, mature region) were secured before histological study.

The average testis weight in untreated normals at autopsy (December) was less than that in October- or December-collected animals. Evacuation of spermatozoa had occurred and the heightened spermatogenetic activity was too slight to counteract this loss. These changes made the proportion of immature and mature testicular regions almost equal while in October- or December-collected newts the mature region is approximately four to five times the immature. Testes of phyone-injected normals weighed more than any of the above groups. While evacuation of spermatozoa occurred here also, such great spermatogenetic activity had been induced that the loss was counteracted and the immature section weighed nearly twice as much as the mature. Similar responses occurred in the untreated and phyone-injected unilateral castrates, but in the latter the immature section weighed approximately five times the mature. Spermatogenesis also increased in the testicular fragment of animals lacking left testis and mature part of right, whether they were untreated or phyone-injected, but it was greater in the latter group.

D2. Correlation films in the study of neuro-anatomy. W. H. F. Addison, Winifred B. Stewart and C. M. Kershner, University of Pennsylvania. (No abstract.)

D3. Histogenesis of the nervous system in albino rat fetuses. A. W. Angulo y González, The Wistar Institute of Anatomy and Biology.

Histological material prepared by the silver technique, photographs, drawings and models will be offered to illustrate the histogenetic development of the nervous system in albino rat fetuses ranging in size from 1.5 to 9 mm. C.R.L. (See also abstract no. 3.)

D4. Differentiation and function of amphibian hypophysis transplants independent of neural tissue. Wayne J. Atwell, Department of Anatomy, University of Buffalo.

The epithelial hypophysis was removed from ninety-three specimens of Rana sylvatica and thirty of R. pipiens at the tail bud stage and transplanted to a location between the right otic vesicle and the hind brain. Care was taken not to include any brain tissue or any entoderm.

For a transplant to be deemed entirely successful, study of an animal was required to show: 1) entire absence of the epithelial hypophysis from the orthotopic position, 2) characteristic hypophyseal tissue in the region of the transplant, 3) evidence of function of the transplant as given below. Twenty-six such specimens of the wood frog and two of the leopard frog have been found in the material studied.

The pigmentary condition of the animal was taken as an indicator of the state of function of the pars intermedia. Function of the anterior lobe proper was evidenced by 1) definite progress toward metamorphosis, 2) preservation of the normal size and structure of the thyroid, 3) maintenance of the size and lipoid content of the adrenal cortex.

All but three of the 'successful' cases exhibited evidences of function of the anterior lobe. These three and eleven others showed a pigmentary condition indicative of pars intermedia function. In one case the transplant apparently had been made directly into the brain wall. This was the only instance of contact between transplant and brain.

D5. Demonstration of a model for the teaching of the nervous pathways of the human brain and cord. Jeff Banks, Department of Anatomy, University of Arkansas School of Medicine. (Introduced by Byron L. Robinson.) (No abstract.)

D6. A new method for staining nerve fibers and endings in mounted paraffin sections. D. Bodian, Department of Anatomy, The University of Chicago. (Introduced by C. Judson Herrick.)

A simple and reliable reduced silver method has been developed for the staining of mounted paraffin sections of central and peripheral nervous systems. Uniform, sharp, and specific staining of nervous elements, including myelinated and unmyelinated fibers, neurofibrillae, end feet of Held, mossy endings in the cerebellum, etc., can be obtained, with a minimum of time and labor.

D7. The distribution of the pepsin-forming cells in the stomachs of various animals as revealed by new methods of staining. D. J. Bowie, Department of Histology and Embryology, McGill University, Montreal. (Introduced by H. E. Rawlinson.) (Illustrating paper no. 12.)

D8. A biometric description of the growth in body weight of the Wistar white rat over a 6-year period. Edith Boyd, Department of Anatomy, University of Minnesota.

A statistical analysis has been made of the body weight of a Wistar white rat colony on a diet of casein 15 per cent, whole milk powder 10 per cent, salt 0.8 per cent, calcium carbonate 11.5 per cent, unsalted butter 5.2 per cent, whole ground wheat 67.5 per cent, since 1927, with 1 per cent cod liver oil added March 1931, kept in a room heated to approximately 72° in the winter and not cooled in the summer. The mean weekly weight during the period of rapid growth fluctuates significantly from year to year, but the mean adult weight does not. The variability in body weight is significantly greater in the male than in the female during the period of rapid growth before 4 months of age but not afterward.

The range of variation in body weight to be expected under the conditions of this experimental colony over a period of 6 years has been defined for both sexes in zones of one, two and three probable errors from the mean weight. These zones would be expected to include the middle 50, 82 and 95 per cent, respectively, of the weights of rats of the same strain kept under similar conditions.

D9. Physiologic incompatibility in species and local races of Amblystoma. Robert K. Burns, Jr., Department of Anatomy, The University of Rochester, School of Medicine and Dentistry.

Larvae of Amblystoma tigrinum and A. punctatum, united in parabiosis, grow in apparent physiologic harmony until late larval life or onset of metamorphosis. At this time the punctatum member suddenly manifests a violent reaction which is almost uniformly fatal, unless checked at once by treatment.

The syndrome comprises edema, discoloration, capillary stasis, hemorrhage, and sloughing of tissues, affecting peripheral parts especially. Typically the limbs are denuded of flesh, gills and tail slough off completely, trunk and head lose large areas of skin, and death follows. However, constant immersion in a solution of mercurochrome usually checks the dissolution, apparently by limiting infection. Skin is then eventually replaced, wounds close, and missing parts regenerate completely. Once overcome, the reaction does not recur. The phenomenon usually coincides with metamorphosis but may occur earlier.

Incompatibility arises whenever tigrinum larvae from the Chicago region are joined to punctatum (of several localities), and, in milder degree, between A. mexicanum and punctatum. However, tigrinum-punctatum pairs from Tennessee do not develop the reaction. A toxic factor entering by transfusion is postulated, which affects the punctatum vascular system, especially at the periphery. Recovery is accompanied by immunity of undetermined duration. Specimens, photographs, and protocols will be exhibited.

A. punctatum bearing heteroplastic grafts of the somatopleure exhibit similar incompatibility; see abstract by R. R. Humphrey.

D10. A vacuum tube microvoltmeter for the study of bio-electric phenomena. H. S. Burr, C. T. Lane, L. F. Nims, Yale University School of Medicine.

A vacuum tube microvoltmeter with suitable electrodes has been designed for the purpose of determining voltage differences in living organisms. The circuit is essentially that of a Wheatstone bridge with two 112A vacuum tubes perfectly balanced. The instrument is stable over long periods of time and has been built to give a sensitivity of 10 microvolts per millimeter with a type R galvanometer. It is so designed that the current drain from the organism is of the order of 10^{-16} ampere and it is independent of interelectrode resistance up to one million ohms. Contact with the animal is made through normal saline leading from the animal to two silver-silver chloride electrodes. These have been shown to be stable over long periods of time and have proved to be the best type for the purpose. Significant studies have been made with this instrument in embryos of salamander, chick and rat, in carcinoma of the mammary gland, in man, and in rabbits and white rats. (See also abstract no. 15.)

D11. Demonstrations of microscopic preparations and biophysical experiments with pressure waves illustrating the significance of the transitional type of musculature in the gizzard of the wild mallard (Anasplatyrhynchos boschas). Eben J. Carey, Marquette University School of Medicine.

a) Sections show characteristics of smooth and striated muscle in the same branched fiber. The cross striations, 25 to 65 μ in length, of this muscle during contraction are the intermediate expressions of pressure between the long pressure waves of the contraction bands of smooth muscle and the short waves expressed as cross striations in striated muscle. The muscle protoplasm is arranged into zones of condensation and rarefaction. b) Demonstration of the explosion by lateral expansion of plate glass rods with fusiform openings when sound pressure waves are amplified by multiple reflections. The sound waves originate by hand-friction-rub with paper toweling moistened with xylol. c) Demonstration of lateral expansion of rubber membrane enclosing water by pressure waves of sound. d) Demonstration of the pressure waves of directed brownian motion of gamboge particles under bombardment of water molecules enclosed in capillary glass tubes. (See also abstract no. 16 and demonstration no. D12.)

D12. Demonstrations of variable patterns and lengths of sound waves in glass rods with aid of polarized light analogous to those of muscular cross striations. Eben J. Carey, Leo Massopust, Walter Zeit and Herbert Poetsch, Marquette University School of Medicine.

a) Demonstration of optical apparatus of polarized light, special camera arrangement and actual visualization of pressure waves of sound in different glass rods. b) Demonstration of variable patterns, lengths and colors related to pressure waves of sound are compared to those of the cross striations of muscle. The patterns of the physical segmentation of glass rods by pressure waves are demonstrated to be highly variable and comparable to muscular cross striations as follows: single and double spirals, straight, curved, intercrossing, vernier scale alignment or 'noniusfelder' of M. Heidenhain, simultaneous presence of fundamental pressure wave with first or other harmonics. c) The immediate replacement of long by short pressure waves of sound in glass rods is compared to the histologic multiplication and replacement of long by short cross striations during muscular contraction. d) Demonstration of short pressure waves of sound caused by activating glass rod to vibrate near supporting clamp and long waves by activating rod near its free end. (See also abstract no. 16 and demonstration no. D11.)

D13. Circulation in new capillaries, effects of cold, and sticking and emigration of leucocytes. E. R. Clark, E. L. Clark and E. A. Swenson, Department of Anatomy, University of Pennsylvania. (No abstract.)

D14. Effects of 1:2:4 dinitrophenol on the early development of the frog, Rana pipiens. Alden B. Dawson, Biological Laboratories, Harvard University.

The early development of the frog is markedly retarded or even arrested by treatment with a-dinitrophenol, effective solutions being from 1 in 750,000 to 1 in 1,000,000. The effect varies with the stage of development at which treatment is begun and is relatively greater when development proceeds at low temperatures, 10 to 12°C.

Complete arrest occurs usually in the late blastula or beginning gastrula. In other cases the blastopore fails to close leaving a persistent yolk plug of varying size. If the defect is small development may proceed and the pore be eventually closed. If relatively large, development usually stops in a late tail bud stage with persistence of the yolk plug.

In persistent blastulae cilia occasionally develop on the external surface. In cases of less marked retardation anomalies of several types are encountered. The external gills may fail to develop, the eye may be rudimentary and the intestine simply folded instead of coiled. The neural tube is frequently defective and papilloform out-growths from the epidermis are often obtained.

D15. The differential staining of the anterior pituitary gland. Alden B. Dawson and Thurlo B. Thomas, Biological Laboratories, Harvard University.

Demonstrations of the anterior pituitary of the rat, differentially stained by 1) Volkonsky's modification of Altmann's mitochondrial technique, 2) Heidenhain's azzan method, a modification of Mallory's connective tissue stain, and 3) Altmann's acid fuchsin followed by orange G and anilin blue according to Mallory.

D16. The healing of experimental rickets in rats. Healing in the head of the tibia as shown by x-ray, line test, and microscopic sections. G. S. Dodds and H. C. Cameron, West Virginia University.

The demonstration includes 1) prints from x-ray films, 2) photographs from line-test preparations, 3) microscopic sections, 4) photomicrographs, and 5) drawings.

The main points shown are 1) spread of calcification, 2) reorganization of metaphysis, 3) restoration of epiphyseal cartilage to normal thickness and 4) to normal structure, 5) reduction in amount of osteoid, 6) reorganization of end of shaft, 7) restoration of normal attitude of trabeculae, 8) restoration of normal amount of marrow and of 9) normal type of marrow, and 10) correction of shape of head of bone.

The material is arranged in twelve stages of healing, so far as possible agreeing with the twelve x-ray stages of Bourdillon et al., '31. An attempt is made to correlate pictures presented by x-ray, line test, and microscopic sections. About eighty rats were used, in which rickets has been produced by the Steenbock-Black diet, and healing brought about by the administration of irradiated ergosterol.

D17. The effect of pituitary hebin upon the reproductive system of the chick embryo. L. V. Domm and E. A. Dennis, Department of Zoölogy, The University of Chicago. (Introduced by F. R. Lillie.) (Illustrating paper no. 30.)

D18. Histological preparations of the jugular ganglion demonstrating chromatolysis of cells following section of the vagus and auricular nerves. Franklin S. DuBois and James O. Foley, Department of Anatomy, University of Alabama. (Illustrating paper no. 31.)

D19. Unmyelinated fibers in the lumbar ventral roots of the cat. Donald Duncan, Department of Anatomy, University of Texas.

Silver pyridine preparations of the lower lumbar ventral roots showing the scattered unmyelinated fibers typical of these roots. The fibers occur singly or in small clusters throughout the entire root and resemble the unmyelinated fibers of the dorsal roots except in number.

D20. A sectional model of a 9.5 mm. human embryo, made of paper. J. M. Essenberg, A. Van Hoey and J. V. Schwind, Department of Anatomy, Loyola University School of Medicine, Chicago. (Introduced by R. M. Strong.)

The model is enlarged thirty diameters and arranged in twenty-one sections. Each section consists of several layers of cardboard fastened together by liquid carpenters' glue. Re-enforcements and stems are made of aluminum strips. The color scheme is as follows: Ectoderm, light blue; mesoderm, red; entoderm, yellow; arteries, carmin; veins, dark blue; cavities, black.

D21. Potential differences across the yolk-sac epithelium of the white rat during the final week of pregnancy. John W. Everett, Department of Anatomy, Duke University School of Medicine.

Potentiometric measurement of the potential difference across the epithelium was made by means of saturated calomel electrodes fitted to a micromanipulator. In a total of ninety-six epithelia, ranging in age from 14 to 20 days, the potentials varied from 0.5 to 31.5 millivolts, the free surface of the epithelium being negative to the underlying mesoderm. Such extremes often occurred within a single litter, the greatest variability appearing during the eighteenth and nineteenth days. Few potentials above 10 millivolts were found in younger litters. The marked increase in the average potential at 18 days is accounted for by the occurrence of many epithelia which gave potentials approaching 30 millivolts The variation within single litters suggests periodic waves of cellular activity. The manifestation of the higher potentials after the seventeenth day may be an expression of a change in the activity of the epithelium in response to its new environment. By this time the yolk sac cavity has become confluent with the uterine cavity as a result of the disappearance of the decidua reflexa and Reichert's membrane. Cytologically, these older epithelia present increased numbers of large, swollen cells, and fewer cells containing lipoid droplets. The facts outlined above will be illustrated by charts, drawings and microscopic preparations.

D22. A model of the Wilson 9-somite embryo (H-98). W. A. Fell, Cambridge University and Carnegie Embryological Laboratory, Baltimore. (Introduced by G. L. Streeter.) (No abstract.)

D23. The effect of phenol indophenol dyes on the eyes of various amphibian larvae. Frank H. J. Figge, Department of Anatomy, University of Maryland.

The pigmentary changes produced in various salamanders by the phenol indophenol dyes were described elsewhere. This demonstration concerns itself with the concommitant changes that take place in the eyes. Mrs. Margaret R. Lewis

previously described the eye defects produced by these dyes in tadpoles as a loss of the pigmented layer and a collapse or folding of the retina. Due perhaps to more prolonged and intensive treatment of the more susceptible Mexican axolotls, greater eye defects resulted. The eye defects appear to be related not only to an inhibition of eye development but to retrograde or degenerative changes. These changes involve not only the retina and the pigmented layer of the eye, but also the scleral cartilage, lens and cornea. There is no uniformity in the susceptibility of the eyes to dye effects. Even in the same animal, one eye may show more marked changes than the other. Of two animals of the same kind, placed in the same bowl of dye at the same apparent stage of development, one may develop defective eyes while the eyes of the other appear normal.

Thus far, defective eyes resulting from treatment with phenol indophenol dyes have been observed only in tadpoles and black and white Mexican axolotls. The dyes appear to have little or no effect on the eyes of Amblystoma punctatum or Necturus. (See also abstract no. 37.)

D24. Staining of peripheral nerves with silver after fixation with chromate solutions. James O. Foley, Eleanor A. Hunt and Walter W. Sackett, Jr., Department of Anatomy, University of Alabama.

The objective in the preparation of peripheral nerves for quantitative analyses is the complete staining and definition of the smallest unmyelinated fibers. Helpful in this direction has been improved fixation of the tissue obtained by the use of variously modified aqueous solutions of potassium dichromate. Modifying reagents employed in different strengths were: 1) ammonium hydroxide, 2) pyridine, 3) ammonium hydroxide and pyridine, and 4) ammonium hydroxide, pyridine and alcohol. Subsequently, the tissues were treated as in the pyridine silver method. The demonstration will consist of histological preparations illustrating the results obtained on normal and partially degenerated vagus nerves. (See also abstract no. 31.)

D25. Evacuation of the human gall bladder in pregnancy. Maude M. Gerdes and Edward A. Boyden, Departments of Obstetrics and Anatomy, University of Minnesota.

Notwithstanding general acceptance of the fact that the greater incidence of gall bladder disease among women is attributable to the bearing of children, there is little agreement concerning the effect of pregnancy upon the evacuation of the biliary vesicle. This is due to the fact that the rate of emptying has never been measured quantitatively.

In the present study the gall bladders of thirteen young women, gravid 5 to 8 months, have been roentgenographed at intervals after a meal of egg yolk and their volumes computed according to the Boyden method, '28. Curves of evacuation thus derived show marked retardation of emptying when compared with curves from a corresponding group of nulligravidae. Thus, at the end of the first 40 minutes, only an average reduction in volume of 49.3 per cent was registered by the thirteen gravidae as against 73.2 per cent by twelve nulligravidae. Five of the thirteen, examined 8 to 10 weeks postpartum, showed marked recovery in the rate of flow, but not a return to the nulligravid mean.

On the basis of Westphal's pilocarpine experiments on pregnant women, we have attributed retardation of emptying during pregnancy to hypertonicity of the sphincter choledochus. This, together with the low bile salt-cholesterol ratio observed in the gall bladder during Caesarian section (Riegel, Ravdin, Morrison and Potter, '35), would seem to afford a rational explanation for the greater tendency toward calculus formation in women.

D26. Demonstrations of 9-, 10- and 11-day embryos of the white rat. Madeleine P. Grant, Sarah Lawrence College, Bronxville, New York.

The rat offers numerous advantages as teaching material in mammalian embryology. Some of the advantages, not possible with pig material, consist in the fact that the student may follow the oestrous cycle from vaginal smears, obtain accurately-timed embryos and study implantation, formation of embryonic membrane and placenta. Inasmuch as there are no adequate descriptions of the development of the rat beyond the 9-day stage described by Huber, these demonstrations are presented as preliminary reports of a fuller study of rat embryology now in preparation.

Micro-dissection of total embryos of 9½-, 10-, 10½- and 11-day stages, stained in alum-cochineal and cleared in glycerine, or methyl salycilate according to Spalteholz, are shown. In these media, embryos may be moved about under the dissecting microscope and studied from any angle. Drawings of total embryos and photomicrographs from slides in the Minot Collection at the Harvard Medical School are included.

Implantation of the embryo occurs on the eighth day following insemination. Bilaterality may be observed on the ninth day when mesoderm is first forming. At 9½ days notochord formation from endoderm first appears, the allantois proliferates from mesoderm and amnion is complete. The 10-day embryo is sharply bent into a V-shaped structure with the dorsal axis on the inner plane of the bend, the embryonic endoderm consequently on the outer. This embryo possesses approximately 4 somites, the foregut invaginates, the amnio-cardiac vesicles fuse. During the next 24 hours the embryo makes a complete bend in the opposite direction with the dorsal axis now lying in the plane of the outer curvature; the somites increase in number, and the nervous, circulatory and digestive systems are rapidly differentiating.

D27. Prooestrous and oestrous behavior in the female guinea pig. Roy Hertz, William C. Young and Edward W. Dempsey, Department of Biology, Brown University.

The behavior of the guinea pig just before and during oestrus follows a definite pattern which is referable to the time of ovulation. Preceding the period of sexual receptivity the animal usually pursues and mounts other animals, displaying typical copulatory movements. This male-like behavior often continues into the early part of the period of sexual receptivity. The latter period is set off from the prooestrum by the appearance of the copulatory response. This response, which can be elicited by tactile stimulation over the lumbar or perineal regions, is characterized by the assumption of a rigid posture, arching of the back, and elevation and dilatation of the vulvar region. The response is most readily elicited

at the onset of heat, and is obtained with increasing difficulty as the end of the period of sexual receptivity is approached.

The motion pictures will illustrate the definiteness of these behavioral phenomena and their adaptability to experimental work on the reproductive cycle.

D28. The immigration of lymphoblasts into the thymus of Salmo fario. Benjamin H. Hill, Department of Anatomy, College of Dentistry, New York University. (Introduced by Margaret M. Hoskins.) (Illustrating paper no. 46.)

29. Studies of heart muscle in tissue cultures. M. J. Hogue, Department of Anatomy, University of Pennsylvania.

Heart muscle from 8-day-old chick embryos has been grown in tissue cultures for over 150 days. The medium used is a combination of chick embryonic extract and Tyrode and Locke-Lewis solutions. Neither plasma nor serum is used. The culture medium is changed every other day until the cultures are 90 days old, then it is changed every day. Muscle cells grow out from the explanted tissue singly and in the form of a network. The explant, the network of muscle cells and the individual muscle cells usually beat some time during the history of the culture, though not necessarily at the same time. In one culture, 143 days old, the network of muscle cells was beating thirty times a minute at room temperature (25°C.). Most of the fibroblasts die when the cultures are from 50 to 60 days old, though later a few fibroblasts wander out from the explant. Cross striations are present in most of the muscle cells stained with haematoxylin. Intercalated disks are not present in stained preparations of 60-day-old cultures.

D30. Thyroid and adrenal conditions in the parathyroidectomized albino rat. Margaret M. Hoskins and Emanuel Schoolnik, Department of Anatomy, New York University College of Dentistry.

The activity of the thyroid at the time of parathyroidectomy and at autopsy, respectively, was determined by drawing follicles with a projection apparatus, cutting out the drawings and finding the proportion by weight of each drawing which represented epithelium. It was found that no significant changes occur in the thyroid in the first 24 hours after parathyroidectomy. Animals in which the activity of the thyroid is above the standard deviation for the series do not develop tetany. Among those with normal and subnormal thyroids immunity to tetany and all degrees of the symptoms occur.

Histological variations in the adrenal cortex were also measured and correlated with the degree of tetany following parathyroidectomy. In all control and operated animals the cortex consists of a light peripheral zone and a darker area immediately surrounding the medulla. The relative amounts of these two zones varies, the lighter forming from 46 per cent to 96 per cent of the cortex. It was found that in all animals having an extensive light zone, symptoms of tetany occur after parathyroid removal.

Thyroid and adrenal conditions are correlated with each other as well as with tetany. The coefficient of rank correlation between thyroid activity and depth of light zone of the adrenal cortex is -0.53 ± 0.069.

D31. A reaction in Amblystoma punctatum induced by the presence of transplants furnished by A. tigrinum. R. R. Humphrey, Department of Anatomy, University of Buffalo.

Amblystoma punctatum carrying transplants which include a large area of dorsolateral skin exhibit a striking incompatibility reaction when the transplants are supplied by A. tigrinum of the Chicago strain. This reaction occurs as the animals approach metamorphosis, and results in death, generally within 2 or 3 days after its onset. It is characterized by thickening and desquamation of the epidermis around the margins of the graft and elsewhere, and by circulatory disturbances which result in necrosis of digits or even entire limbs. The heart action may be very rapid after the onset of the reaction (90 or more per minute) but very slow preceding death; the cutaneous vessels are often greatly dilated.

No incompatibility is apparent when comparable transplants are furnished by A. tigrinum of the Tennessee strain. Transplants furnished by A. mexicanum induced a reaction (atypical) in only one out of thirty-six possible cases.

The reaction can be duplicated in normal premetamorphic punctatum by introduction into the peritoneal cavity of skin from Chicago tigrinum, or skin from a transplant in a host beginning to show the reaction. This with other evidence indicates the reaction to be due to secretions from the cutaneous glands of the transplant.

The demonstration includes charts, photographs and microscopic preparations to illustrate the reaction phenomena.

A. punctatum in heteroplastic parabiosis exhibit similar incompatibility reactions; see abstract by R. K. Burns.

D32. Secondary lymphoid nodules from lymph nodes of rat, cat, dog and man. James E. Kindred, Laboratory of Histology and Embryology, University of Virginia Medical School. (Illustrating paper no. 60.)

D33. Microscopic demonstration of living frog organs trans-illuminated with the fused quartz rod. M. H. Knisely, Department of Anatomy, The University of Chicago. (Introduced by R. R. Bensley.)

As is well known, there are intimate relationships between the structure and function of an organ and the structure and functioning of its vascular system. The demonstration will facilitate comparison of the total vascularity, the pattern of finer vessels, the relative volume of blood supplied to, and the conditions of blood flow in selected organs.

D34. Pinocytosis. Warren H. Lewis, Carnegie Institution of Washington, Baltimore.

Macrophages and various malignant cells from both sarcomas and carcinomas when cultivated in vitro frequently engulf droplets with their peripheral ruffle-like pseudopodia. The droplets there move toward the center of the cell and shrink to granules. The process is not continuous, it may be entirely suppressed at times and very active at others. The conditions in the medium or in the cell which activate the process are unknown.

D35. Demonstration of further contribution to the use of infra-red photography in anatomy. Leo C. Massopust, Department of Anatomy, Marquette University. (Introduced by Eben J. Carey.) (No abstract.)

D36. Variations of cell types in the pituitary of Fundulus. Samuel A. Matthews, Department of Anatomy, University of Pennsylvania.

The pars glandularis of the pituitary of Fundulus may be divided into a large anterior region, the so-called transitional portion, and a narrow pars intermedia bounding the processes of the pars nervosa. Chromophobes, basophiles and acidophiles occur in both regions of the pars glandularis. The transitional portion is predominantly chromophobic in animals killed in late May and July, acidophiles appearing in the fall and persisting throughout the winter though staining less intensely in late winter and spring.

The major portion of the pars intermedia is made up of chromophobes and basophiles. In many animals, however, acidophiles occur in a single layer of cells separating the rest of the pars intermedia from the pars nervosa. The percentage of acidophiles varies considerably in different cases, the highest percentages occurring in May, July and September and the lowest in March and April, but there is considerable variation in individual animals. In addition to these cell types a special type of basophile with large, deep-staining granules occurs in the pars intermedia of many animals, particularly in those killed during the summer and fall.

D37. Cardiovascular tracings. Cecilia C. Mettler, W. F. Hamilton, Lane Allen, R. A. Woodbury and Fred A. Mettler, Department of Anatomy, and Department of Physiology and Pharmacology, University of Georgia School of Medicine. (Illustrating paper no. 73.)

D38. Demonstration of techniques for use in teaching gross and neuroanatomy. Fred A. Mettler, Department of Anatomy, University of Georgia School of Medicine.

The Negocoll method of Poller: Exhibition of positive casts made in Hominit, Celerit and plaster from Negocoll negatives of gross specimens, dissections, cross sections and plasticene models.

Cellophane jackets for museum specimens to facilitate access and reduce cabinet expense.

The dioxan-paraffin technique: Fix, wash, place in 1, 4 diethylene oxide (dioxan) until clear, embed in paraffin dissolved in dioxan, section, mount, dissolve paraffin out with dioxan, wash in water, stain and treat as usual.

The cellosolve-nitrocellulose technique: Fix, wash, clear in ethylene-glycol-monoethyl-ether (cellosolve) place in graded concentrations of 'nitrocellulose ½ sec.' at 50°C. up to 4 per cent of the solid, transfer to nitrocellulose-alcohol-ether solutions and embed. Section as usual. Stain. Dehydrate to 95 per cent alcohol. Clear in terpineol (lilacine), place section on slide and flush with xylol if matrix is to be left on or with methyl salicylate if it is desired to eliminate it. Mount in balsam. If slide is to be used immediately ring with euparal to keep cover in place.

Painting of museum specimens: Dehydrate specimen in alcohol, paint with lacquer made by dissolving nitrocellulose in methanol 40 per cent sulfuric ether 50 per cent butanol 10 per cent and suspending stable Toch Bros. pigment in the solution, place specimen in 70 per cent alcohol, Kaiserling II or solution of glycerin, 25 parts; formaldehyde, 157; potassium nitrate, 15; borax, 4; boric acid, 12; thymol, 1; water 280.

D39. Structure of the giant salivary gland chromosomes in relation to cell growth. C. W. Metz, Department of Embryology, Carnegie Institution of Washington, Baltimore. (Introduced by G. L. Streeter.)

The giant chromosomes of embryonic gland cells, particularly those of the salivary glands, in Diptera, provide exceptional opportunity for study of the relation between chromosomes and cell growth and differentiation. The cells and nuclei of the salivary gland grow to thousands of times their original size without division. One view holds that the great size of the chromosomes is due to internal multiplication of parts (chromonemata) thus implying that there is a fixed limit to the size of the basic structural elements in a chromosome, and that a direct relation exists between chromosome size and multiplication of these elements. So far as visible evidence goes, our results do not support this hypothesis.

Demonstration includes entire glands and selected specimens illustrating conditions in normal, living cells as compared with those in cells fixed and stained in various different ways.

D40. The endometrium of pregnancy. H. W. Mossman, Department of Anatomy, University of Wisconsin.

Microscopic preparations of implantation sites and other portions of the endometrium at various stages of pregnancy in a variety of animals will be demonstrated. They will illustrate epithelial degeneration, epithelial syncytium formation, several types of giant cells, vascular dilatation and stasis, endothelial swelling, blood extravasation, edema, various types of decidual cells, degeneration of the decidua, changes in the glands, etc. Study of this material has indicated to the author that most of the 'destructive' processes going on in the pregnant endometrium are not due to the direct action of the trophoblast, but rather to vascular changes in the uterus probably brought about by the maternal endocrine system acting through some relatively simple vaso-motor mechanism. (To accompany round table.)

D41. Hyperplastic and metaplastic changes in the uterus of the guinea pig induced by prolonged administration of oestrone. Warren O. Nelson, Yale University School of Medicine.

The administration of oestrone (theelin) in dosages of 40 to 100 R.U. daily for periods of 1 to 6 months in spayed female guinea pigs has induced marked changes in the uterine mucosa. All animals have shown excessive endometrial hyperplasia of the 'Swiss-cheese' pattern. In instances where treatment was continued for at least 4 months a striking metaplastic epithelium occurred regularly at the tips and in the crypts of the glands of the fundus. In addition, the cervical portion of the fundus had the inner muscular layer largely replaced

by a dense, irregular layer of squamous epithelium showing keratinization and 'pearl' formation, and apparently extending from the transformed cells of the crypts.

The daily injection of $\frac{1}{8}$ to $\frac{1}{4}$ rabbit unit of progestin for 10 days in animals showing the effects described above has resulted in a partial to complete disappearance of the hyperplastic condition, but in the amounts thus far employed has not significantly altered the metaplastic changes.

D42. Neurofibrillar development in the spinal cord of rabbit embryos (pyridin-silver). D. S. Pankratz, College of Medicine, University of Tennessee. (Illustrating paper no. 80.)

D43. Microscopic preparations of the human hypophysis. A. T. Rasmussen, Department of Anatomy, University of Minnesota.

a. Chromophobes (chief cells) apparently within basophils. This has been interpreted as endocytogenetic origin of chromophobes.

b. Basophil and chromophobes apparently within acidophils.

c. Series of three sections through a basophil with two apparently intracellular acidophils, which actually are only partly surrounded by the basophil. This is considered the real explanation of a and b.

d. Transitions from typical cells of pars intermedia into typical basophils.

e. Hyaline changes in the basophils of the anterior lobe characteristic of Cushing's so-called pituitary basophilism (from a 13-year boy with carcinoma of one suprarenal) and similar changes in some of the basophilic cells of the posterior lobe.

f. Scattered basophilic cells in the posterior lobe which might have been interpreted as nerve cells by older authors.

g. Nerve cell in the posterior lobe. The only specimen encountered in serial sections of about 300 human hypophyses that could be interpreted as a nerve cell.

h. Anterior lobe of the hypophysis in advanced pregnancy, indicating hypertrophy and acidophilia of the chromophobes, rather than degranulation of basophils. (See also abstract no. 86.)

D44. Studies of the arterial arrangement in the human kidney with emphasis directed to the crossing over of interlobar arteries in the substance of the kidney. George Nelson Ronstrom, Department of Anatomy, Louisiana State University Medical Center. (Introduced by B. I. Burns.)

In studying the distribution of the larger vessels in the substance of the kidney, interlobar arteries were observed crossing over from the posterior area through the mid-plane to supply the anterior area and vice versa. This fact, so well demonstrated at the poles of the organ, contradicts any strict division of the renal artery into a definite anterior division supplying only anterior surface and a definite posterior division supplying only posterior surface.

A question is raised as to the desirability of using the term arciform in relation to interlobar arteries near the base of the pyramids. The vessels divide dichotomously as they course to the kidney surface with their concavities more often than their convexities facing the lateral edge of the kidney.

In none of the casts have anastomoses been demonstrated between arteries of adjacent pyramids.

D45. Histiocytes in the hypophysis of the bat. Elizabeth L. Sawyer and Mary J. Guthrie, Department of Zoölogy, University of Missouri.

Histiocytes are typical cells of the hypophysis which can be distinguished clearly from the secretory cells. These macrophages are recognizable after fixation in fluids containing formalin and after vital staining with trypan blue. Identification is made on the basis of nuclear and cytosomal characteristics. The presence of numerous histiocytes in the hypophysis is probably to be correlated with the many degenerating secretory cells that occur. Preparations of entire, sectioned, and macerated glands will be shown.

D46. Quantitative studies on the human spine in prenatal life. Richard E. Scammon, The Graduate Faculty, University of Minnesota.

An analysis has been made of each of the cervical, thoracic and lumbar vertebral segments of about 100 fetuses ranging from about 10 to over 50 cm. in total or crown-heel length. The vertebral segments were measured in their vertical axis; a segment consisting of one ossification of the body of a vertebra plus one-half of each intervertebral disk contiguous to it.

It was found that the vertebral segments always bore a rectilinear relationship to the total body length and to the length of the total free spine.

Constant rates of absolute growth (with respect to body length and to spine length) are already present in the fourth fetal month and do not change. They fall in serial order of magnitude from the cervical to the lumbar end of the spine.

Magnitudes of the segments of the free spine do not fall in serial order cranocaudally until about 4 months. Thereafter they maintain this order.

The relative rates of growth do not show this regular order of growth either in early stages or in the newborn.

The material indicates that while the growth of the segments of the (free) human spine is regular in the fetal period, there has been extreme irregularity of growth at an earlier time.

D47. The increase of chemical elements in the human fetus. Richard E. Scammon, The Graduate Faculty, University of Minnesota.

This demonstration deals with the graphic and analytic treatment of a new set of data collected by Swenson and Job, under the direction of Dr. Bengt Hamilton. The elements considered are phosphorus, calcium, sodium, chlorine, potassium and magnesium.

A statistical analysis of the sample of the fetal population studied indicates that it is within the usually accepted range of normal. The greatest increase is found in phosphorus and calcium, the least in magnesium. The velocities of growth of calcium, phosphorus and sodium are high in the later fetal months. Those of chlorine, magnesium and potassium are low after 8 lunar months.

The relative rate of increase is rapid between 3 and 5 lunar months for all elements studied; thereafter the relative rates of increase become fairly uniform. The greatest drop in relative rate of increase is in phosphorus, sodium, chlorine and potassium. Calcium and magnesium show less change in relative rate of increment.

All of these increases of chemical elements can be well represented by some form of logistic expression when related to total body length. This was found true of most chemical components of the body, but is in marked difference from that found for the growth in weight of most organs and parts of the body and for the growth in weight of the body as a whole.

D48. Quantitative studies on the relative growth of the cerebrum and its parts. Richard E. Scammon, The Graduate Faculty, University of Minnesota.

The study of proportionate growth of the human cerebrum has been done in a variety of methods. The material here presented seems to indicate that length of the cerebrum at all ages approaches a constant of the cube of its volume, that its volume approaches a constant of the two-thirds power of its 'free' surface (surface of sulci omitted), and that the length of the cerebrum approaches a constant of the square of its 'free' surface. 'Total' surface, including the surfaces of all measurable sulci, and cerebral volume bear fairly constant relations to one another during the developmental period. Measurements of the gray and white matter confirm the views of previous students that the latter grows relatively more in postnatal life, although there is great difference in growth of the various areas of white matter. The relative growth in mass of the corpus callosum and the optic tract is particularly striking. The basal nuclei grow more proportionally than the volume of the cortex. There is a remarkable postnatal increase in the volume of the caudate and amygdaloid nuclei; the thalamus shows less relative increase. The lateral and medial geniculate bodies increase very little in mass after birth. The relationship of the growth of all parts of the cerebrum is more closely related to cerebral volume than to prenatal or postnatal age.

D49. Bone growth in vertebrae and ribs in 12- 13- 14- and 15-day chick embryos. Nancy Schroeder, Sarah Lawrence College, Bronxville, New York. (Introduced by Madeleine P. Grant.)

Sandstrom demonstrated at the meetings of the American Society of Zoölogists in 1935 the need of detailed studies of bone formation in the chick. Early stages of ossification in vertebrae and ribs are here demonstrated by Spalteholz preparations in addition to illustrative drawings and charts.

Ossification of the vertebral portion of thoracic ribs begins approximately on the twelfth day. By the fourteenth day ossification has begun in thirty-six of the vertebrae. Vertebrae of the anterior region show four primary centers, namely, ventral and dorsal plates of the centrum, right and left neural arches. Vertebrae of the lumbar-sacro-caudal region show ossification in only the ventral and dorsal plates of the centrum, the last one in only the ventral plate. It therefore seems likely that the first center appears in the ventral plate of the centrum, the second in the dorsal plate and, finally, in the right and left neural arch.

Although ossification generally proceeds in an anterior-posterior order, careful analyses reveal exceptions. In a 14-day chick, bony centers in the neural arches appear in all cervical and the first two thoracic segments. The series shows a definite anterior-posterior order of differentiation, but exceptions to such a

developmental sequence appear in the centra and ribs. Centra ossify in the cervical region in an anterior-posterior order, in the thoracic region in a posterior-anterior order and in the lumbar-sacro-caudal region in an anterior-posterior order. Rib elements of the cervical region show an anterior-posterior differentiation, while true thoracic ribs ossify in a posterior-anterior direction except for the seventh, or last, which shows definite retardation. Rib elements in the lumbar-sacro-caudal region have not appeared in this 14-day chick.

D50. The development of the sphincter of Oddi in the human fetus. R. A. Schwegler, Jr., and E. A. Boyden, Departments of Obstetrics and Anatomy, University of Minnesota.

Notwithstanding 60 years of investigation, the methods hitherto used have resulted in disagreement as to the arrangement and interpretation of muscle at the choledocho-duodenal junction. Accordingly, a new approach to the problem has been attempted—namely, the resort to simpler stages and their reconstruction in wax.

Displacing the theory that the muscle sheath which surrounds the ducts "grows at the expense of the intestinal musculature" and is "an emanation from it" (Rietz, '17; Porsio, '33), this study demonstrates that the musculus proprius of the ducts differentiates in situ from mesenchyma. This process starts at the level of the window in the circular layer of the intestine (43-mm. stage) and progresses toward the orifice until, by the fifth month, all but the distal third of the ampulla is enclosed in an intrinsic sheath of fibers. At the point where the ducts penetrate the gut wall, the margins of the window contribute scattered bundles of fibers to the outer (longitudinal) coat of the sheath. The inner (circular) coat is exclusively intrinsic in origin. It forms a weak sphincter about the ampulla, but reaches its greatest development around the bile duct just before the latter enters the ampulla. It is this *sphincter proprius ductus choledochi* that retains the bile against the secretory pressure of the liver between meals and which, when overstimulated, produces biliary stasis and hypochondriac pain.

D51. The appearance of myelinated nerve fibers as observed with polarized light. H. E. Setterfield, Department of Anatomy, Ohio State University. (Introduced by R. A. Knouff.) (Illustrating paper no. 94.)

D52. A cinematographic study of ocular responses elicited by stimulation of the cerebral cortex. Wilbur K. Smith, Department of Anatomy, University of Rochester, School of Medicine and Dentistry. (Illustrating paper no. 100.)

D53. A new method for the rapid staining of myelin sheaths. Wilbur K. Smith and Brian Quigley, Department of Anatomy, University of Rochester, School of Medicine and Dentistry. (No abstract.)

D54. Motion pictures of single fibers of striated muscle in living frog tadpoles during growth, injury and repair. Carl Caskey Speidel, Department of Anatomy, University of Virginia Medical School.

These pictures record in living frog tadpoles many details of histological changes in individual striated muscle fibers during growth, injury and repair. Included are several examples of active myoblasts showing migration, multiplication, plasmodium formation, and internal movements during the origin of myofibrils and cross striae; continuous case histories of muscle regeneration photographed from 3 to 20 days after injury; disappearance of an aberrant fiber; irritated fibers near a wound; early degeneration showing segregation of myofibril groups within a fiber; effects of starvation; effects of alcohol treatment showing retraction, partial retraction, fibrillation, and granulation of Q discs; reaction of sarcolemma and cross striae to heat; muscle cell mitosis within detached portion of scalded fiber, 4 days after injury; prolonged individual case histories of fiber repair and growth for more than a month after scalding; muscle recovery 3 days after dehydration with hypertonic salt solution; varieties of muscle contraction including uncoordinated twitches, tetanus of mature fibers, young fibers, plasmodia, and abnormal peristaltic-like contraction wave; examples of retracting fibers detached at one end showing the disappearance of resting striae and formation of contraction bands; polariscopic pictures of resting and twitching fibers; and the changes during four successive periods of injury and recovery of the same fiber stimulated electrically. (See also abstract no. 104.)

D55. Embryology of the gonads of the marsh hawk, Circus hudsonius. Allan J. Stanley, University of Iowa. (Introduced by Emil Witschi.)

The gonads of Circus hudsonius are bilateral and nearly symmetrical organs throughout the life of the bird. The right and left ovaries are equal in size at all stages. The embryonic testes are likewise equal in size and shape, both possessing a conspicuous cortex. Some cortical elements of the right testis persist until the bird is at least 4 months of age, completely disappearing by the age of 7 months. The cortex of the left testis occurs in small islets which are dispersed over the ventral surface of the organ. These cortical elements may persist slightly longer than those of the right side, but have also completely disappeared at the age of 7 months.

It is also to be noted that no right oviduct has been observed. Only the left oviduct develops. The right ovary, however, becomes functional with respect to the formation of ova, even though no oviduct is present to subserve it. The right oviduct is therefore considered to have disappeared earlier than the right ovary in the phylogenetic history of the Aves.

D56. Observations on the posterior median aperture of the fourth ventricle. R. M. Strong, Ethel A. Chapman and Albert Dado, Department of Anatomy, Loyola University School of Medicine, Chicago. (Illustrating paper no. 109.)

D57. Presence of fluid in the pulmonary chambers ('alveoli') of the frog. Robert J. Terry, Department of Anatomy, Washington University, St. Louis. Methods for recovering the lung fluid and specimens of the latter will be shown.

D58. Accessory sacro-iliac articulations. Mildred Trotter, Department of Anatomy, Washington University, St. Louis.

In the skeletal collection of the department 35 per cent of the pelves show one or more accessory sacro-iliac articulations. The joint surfaces occur on the sacrum in the region of the lateral sacral crest and on a level with the first or second posterior sacral foramina, and for the ilium on the medial surface of the posterior superior iliac spine or on the tuberosity which is the rough surface above the auricular surface of the bone. The high incidence of these articulations is of interest since these joints are ignored in modern textbooks of anatomy and orthopedic surgery. The variations occur more frequently in whites than in negroes (the racial difference is statistically significant) and in males than in females. The common arrangement of the variation is a single accessory sacro-iliac articulation on each side. The skeletons with accessory articulations are slightly older than those without the variation.

D59. Standards of variation of the weight of the adult human kidney, and the effect of pathological conditions upon kidney weight. Herbert Wald, Department of Anatomy, University of Minnesota. (Introduced by Edith Boyd.)

The percentile method of Galton has been used to establish a standard of normal variation in the weight of the adult human kidney for each sex. Only the organs from persons dying of accidents within 24 hours of injury without gross hemorrhage and without evidence of disease were considered normal. When the weight of kidney for the major causes of death recorded in the past 15 years in the University of Minnesota Department of Pathology was compared with the standard, it was found to be increased by passive congestion, cloudy swelling, kidney abscess, amyloid deposits and kidney tumors; and decreased by chronic glomerulo-nephritis, hypertension without severe congestion, and gross hemorrhage.

D60. A histological study of transplanted sympathetic ganglia in the cat. James W. Ward, Department of Anatomy, Vanderbilt University School of Medicine. (Introduced by Sam L. Clark.)

Fifty-one grafts of lumbar sympathetic ganglia containing surviving neurons were secured. In each case a ganglion was grafted into an intercostal space of the same animal. In four animals the intercostal nerves to the region of the graft were removed. At a given time each ganglion with its surrounding muscle mass was removed from the host and fixed appropriately for staining. Each graft was stained either with hematoxylin, with toluidin blue, or according to Ranson's pyridine silver method. Neurons were identified in a graft 287 days old. Degenerative and regenerative processes in the neurons of all transplanted ganglia were studied. In this connection observations were made on the following: 1) the occurrence of argentophil granules in the grafts and in some of the 'normal' sympathetic ganglia of a few of the same animals; 2) chromatolysis and reappearance of Nissl material in surviving neurons; 3) degeneration and regeneration of neuronal processes and cell bodies of the grafts; 4) types of endings of nerve fibers found inside and outside of the transplanted ganglia; and 5) the orientation of the nerve fibers in and around the grafted ganglia.

D61. Intranuclear crystals in the hepatic cells of the dog. Harold L. Weatherford, Department of Anatomy, Harvard Medical School. (Illustrating paper no. 121.)

D62. Mechanical factors determining cell patterns in retina and cartilage cultivated in vitro. Paul Weiss and Frances Dorris, Department of Zoölogy, The University of Chicago.

In previous experiments on mesenchyme (P. Weiss, '29) and nerve fibers (P. Weiss, '34), the method of tissue culture was found a most advantageous one for the analysis of the factors involved in tissue formation. The important role of mechanical factors had been demonstrated. Recently, observations have been extended to the retina, the tapetum and the scleral cartilage of the embryonic chick cultivated in vitro, yielding additional examples illustrating the trajectorial character of cell patterns. The tissues growing independently in the culture assumed quite abnormal shapes under considerable folding, whereby the orientation and the grouping of the cells were again found to depend definitely upon accidental mechanical conditions prevailing in the various parts of the tissue.

D63. The distribution of the so-called primordial germ cells in early chick blastoderms and their relationship to sterile gonad formation in chorio-allantoic grafts. B. H. Willier and Mary E. Rawles, University of Rochester.

The position of the primordial germ cells has been plotted from an examination of serial transverse sections of pre-somite and early somite blastoderms. These cells are widely scattered through the anterior one-third of the blastoderm occurring chiefly in a broad anterior and anterolateral area (not confined to the junction of the opaque and pellucid areas). They seem to be moving in from their seat of origin (germ wall endoderm) and occasionally are found in or near the median embryonic axis before the blood vessels form. They are more abundant in early somite than in pre-somite stages, yet occur in early primitive streak blastoderms.

Transplantations of the node region of head-process blastoderms and of whole blastoderms (early somite stages) after complete or partial removal of the area containing the bulk of the germ cells, were made to the chorio-allantoic membrane. Gonad developed infrequently. In ten cases examined it consists of sterile male-like sex cords with no trace of ovarian cortex. Such results indicate that the gonad rudiment can arise and differentiate independently of germ cells. The theory of extra-gonadal origin of germ cells is thus supported. However, this is not considered a crucial experiment since 1) sterile gonads occasionally appear in grafts (of gonad-forming areas) containing an abundance of germ cells and 2) the same graft conditions which appear to inhibit gonad differentiation may likewise prevent the origin of germ cells within the gonad itself.

D64. The action of natural and synthetic oestrogenic agents on the anterior hypophysis. J. M. Wolfe, Department of Anatomy, Vanderbilt University School of Medicine. (Illustrating paper no. 127.)